Understanding the External Firm Factors Impacting Innovation in the Hardwood Veneer Industry

Amy D. Jahnke

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
Forest Products

Robert L. Smith
Scott Bowe
Deborah Cook
Janice Wiedenbeck
Devi Gnyawali

April 13, 2012
Blacksburg, VA

Keywords: innovation, hardwood veneer, business strategy

Understanding External Firm Factors Impacting Innovation in the Hardwood Veneer Industry

Amy D. Jahnke

Abstract

Innovation research in the wood products industry has historically focused on factors that the firm can influence or control, as opposed to factors external to the firm. The purpose of this research is to understand how the external factors of the firm (i.e., social, technological, economic, ecological, and political or STEEP factors) impact Schumpeter's five-factors of innovation (i.e., sources of supply, methods of production, markets, products and services, and business models) in decorative hardwood veneer producing firms. Case studies of hardwood veneer firms in Austria and the United States were conducted to understand these impacts from individual firms' perspectives. Innovation strategies of the companies were identified based on their use of innovation resources, leverage of those resources and capabilities to serve customers and markets, and deliberateness or emergence. Interviews of experts in each of the environmental areas from both geographic regions also were conducted to qualify and validate the impacts. An online survey was conducted with hardwood veneer companies in Austria, Germany and the United States to quantify the impacts in these regions, and results were analyzed via cluster analysis to better understand the environmental impacts to innovation and the strategies firms were employing to innovate.

The results of the study identified American firms as being most impacted by economic environmental factors and Austrian firms most impacted by social factors. Austrian/German and US firms both made more deliberate than emergent attempts to innovate. US firms most attempted to innovate their business models, while Austrian and German firms most attempted source of supply and product and service innovations. The major implications of this research are the awareness firms in the hardwood veneer industry can gain from understanding the innovation strategies their firms employ, how the environment they function within impacts their innovation, and what they can do about it. By helping this niche industry create sustainable competitive advantages, the industry can overcome the adversities of the mature industry

lifecycle phase, including competitive threats from substitute products and increased competition from foreign log buyers, and shift back into a growth phase of the lifecycle.

Acknowledgements

I would like to thank my committee members for their suggestions and support.

I would like to sincerely thank the Marshall Plan Foundation for the opportunity to expand my research to a project with an international scope.

I would also like to thank the professors, staff and students at Salzburg University of Applied Sciences in Kuchl and the International Office in Urstein for answering my questions and making my stay in Austria a memorable and fruitful experience.

I would also like to say thanks to my friends and family for their support, love and kindness.

Mostly, I would like to thank the interview respondents from the companies as well as the experts. Without their help, this work would not have been possible.

Table of Contents

Table of Figures

List of Tables

Chapter 1. Introduction and Literature Review

The hardwood veneer industry is a mature industry that is facing competitive threats from substitute products like laminates and digital printing of low quality wood substrates, highly competitive firms that often deplete market share from competitors by participating in price wars, and lack of product differentiation from the historically valuable markets of door, panel, furniture and cabinet markets (Anonymous, 2009). The current economic crisis has dramatically impacted firms of the hardwood veneer industry to the point of plant closures and drastic cutbacks in terms of human resources and production. In addition, the veneer production process is labor intensive and advances in technology have been slow to be developed or integrated into the production process. The hardwood veneer industry is in need of new strategies for creating competitive advantages that help buffer them from the impacts of external firm factors like the aforementioned economic and technological factors.

Hardwood veneer industry firms are sandwiched between the needs of the forest management sector to harvest timber in a sustainable, responsible fashion while obtaining the highest possible price for their products, and the wants of the consuming industries (door, panel, furniture, etc. manufacturers) that must respond quickly to changing trends in end consumer preferences and decreasing prices for their products. Since 1992, when the Austrian parliament was one of the first countries to act unilaterally to curb imports of tropical timber from unsustainable sources (Anonymous, 1993), countries have been incrementally adopting more stringent import policies for various wood products and wood species. For example, the European Commission further strengthened legislation to prevent illegal wood from entering their supply chains, from roundwood to furniture products, by defining licensing procedures of due diligence systems in all member states (Dimas, 2008). Policies like this tend to protect overexploitation of forest resources as well as labor markets in exporting countries, many of which are also developing countries. However, the new policy could complicate the procurement process by causing an undue economic burden on importing firms to perform due diligence, when only about 5% of the wood consumed in the EU is of potentially illegal origin (Oliver, 2009). The US equivalent of European legislation regarding trade of illegal wood products is the Lacy Act.

In addition, trends in consumer preference for species have changed over time. In the US, Ohm (2005) reported that maple, cherry, oak, birch, and hickory accounted for 95 percent of kitchens

built in 1996, but accounted for only 75% of the kitchens built 10 years later. This decline is due to the use of a wider variety of species, some new to kitchen construction (Ohm, 2005). Forth (2008) reported that consumers wanted a wider variety of colors and finishes, but expected species preferences not to change from traditional US hardwood species of maple, cherry, oak and hickory. However, as previously described, US firms are having trouble competing for the highest qualities of these same domestic log species, including walnut (Luppold, 1994). In the US cabinet industry, Olah, et al. (2003) reported that an estimated 156 million ft^2 of veneer was used in cabinet production in 1999 and was expected to increase by 2001.

Hardwood veneer firms thus have great challenges in developing strategies to obtain or maintain a competitive advantage that balances these needs and wants of other industry sectors. For example, competitive ability in terms of efficient raw material usage between US and European firms has been debated since the 1970's (Luppold, 1994). European markets have a preference for thinner veneers, giving European firms a competitive advantage in terms of raw material usage and thus financial resources (Luppold, 1994). This allows them to outbid US firms and pay a premium to the US forest management sector for the highest quality domestic veneer logs (Luppold, 1994). Regulation of log exports could alleviate some of the issues, but hasn't been legistlated on account of the many detractors. For example, if a log export ban were introduced, it is likely that more foreign firms would start production in the US. During economic cycles of recession and depression, these foreign firms established in the US would cause overcapacity within the industry and decreased profits, to the detriment of domestically owned veneer firms (Luppold, 1994). Despite the fact that less than 2% of all domestic logs harvested are exported (Luppold, 1994), this debate persists today (Freeman, 2009).

Innovations are both an important source of competitive advantage for firms and a driving force that can pull the economy out of cycles of recession and depression (Schumpeter and Opie, 1968). Drastic changes in environmental conditions, like that of the current economy (i.e., housing market bubble bursting), can wreak havoc on the strategies firms have developed to create new sources of competitive advantage. For example, the aforementioned lack of technological change by veneer technology firms has been a factor for some hardwood veneer producing firms to create their own technology. Some examples are creation of an inventory control system for a veneer warehouse by Curry-Miller Veneer Company (Blackman, 1993),

development of new slicing technology by the Danzer Group (Danzer, 2002) and launching a new online veneer design center that allows users to create projects and view veneer spliced in common patterns by M. Boehlke Veneer Corporation (Boehlke, 2010). In order for the industry to innovate and thrive, the various issues affecting innovation of the hardwood veneer industry must be understood. The question this research aims to answer is: how do external firm factors, hereafter referred to as environmental factors, impact innovation strategies in the hardwood veneer industry?

The proposed research will advance the current knowledge of innovation theory by expanding the application of Schumpeter's theory of innovation to an industry previously unexplored and by exploring the impacts of environmental factors on each of the five dimensions of innovation. Due to the similarities of Schumpeter's five dimension model of innovation to economic theory, supply chain theory and Porter's value chain theory; advancement of these theories is also possible by the proposed research. Additionally, this research will improve upon boundary scanning activities (i.e., information gathering activities conducted by firms to understand the environment external to the firm) of veneer industry firms by giving insight into how the environmental factors will impact innovation within the industry. This research may also provide firms with insight into how to incorporate their boundary scanning activities into development of effective innovation strategies. The research methods may also be applied to other sectors of the wood products industry or to other industries to aid in development of innovation strategies.

The Hardwood Veneer Industry

An industry is defined as a group of firms whose products are close substitutes for one another (Porter, 1998). The hardwood veneer industry under investigation in this study is a group of firms whose product is hardwood sliced veneer. This group includes primary producers of veneer, or those firms who utilize raw materials (i.e., hardwood logs) to manufacture a product (i.e., veneer) to be used by a secondary manufacturer (i.e., furniture, door, panel, etc.). But, it also includes veneer traders, who purchase veneer from primary producers and sell to the secondary manufacturing industries.

Veneer is a thin slice of wood whose thickness dictates how it will be used and ranges from 0.1mm to 7mm (Lincoln, 1984). The two main classifications of veneer, constructional and

decorative veneer, demand differing thicknesses for their applications (Lincoln, 1984). Constructional veneers are used for plywood, corestock and utility articles and are typically thicker veneers. Decorative veneer is used for its "surface aesthetic appeal" (Lincoln, 1984), and can be applied on store fixtures, high quality cabinets, wall panels, furniture, and flooring (Schramm, 2003; Wiedenbeck et al., 2004). For the purposes of this project, the firms producing or trading sliced hardwood veneer for decorative applications are those of primary interest.

The production of sliced hardwood veneer is a global industry. Originating in ancient Egypt in 1490 B.C., veneer production has spread through the years to Greek and Roman civilizations, across Europe and eventually to North America by the early 1800s (Callahan, 1990). Today, veneer and veneer log markets have expanded to many other parts of the world. The Chinese currently hold a very dominant position in the marketplace, especially in terms of production of veneer. In 2009, production of veneer sheets (construction and decorative grades, excluding veneer used in plywood) in China was an estimated 3,120,000 m^3 (FAOSTAT, 2011). Other developed and developing markets for veneer production can be found in Southeast Asia (2,012,900 m^3), South America (1,555,100 m^3), Africa (1,006,711 m^3), Eastern Europe (613,117 m^3) and India (285,000 m^3) (FAOSTAT, 2011). Globally, production of veneer sheets in 2009 was 11.8 million m^3 (FAOSTAT, 2011). The hardwood veneer industry firms of Austria, Germany and the United States are of particular interest for this project.

The wood products industry is the second largest employing industry in Austria following tourism (proHolz, 2010). With 30,927 workers and 1556 active companies in 2008, the Austrian wood sector is dominated by sawmills, followed by building construction, furniture, derived timber products, and ski industry firms (Fachverband, 2009). In 2007, production of veneer sheets in Austria (construction and decorative grades, excluding veneer used in plywood production) was 45,000 m^3 (FAOSTAT, 2011). Anecdotal evidence suggests that there were about 10 decorative hardwood veneer manufacturers or distributors whose primary business was veneer sales in Austria until 2008. In 2009, one firm closed and many others experienced dramatic decreases in sales volumes due in part to the global economic crisis.

The forest and wood products sectors in Germany are large contributors to manufacturing driven economy of the country. These sectors are said to employ more than 760,000 people in over 129,000 companies (HVN, 2011). The number of employees in the wood products sector is now

greater than the automobile industry in Germany, which has only 732,000 workers (HVN, 2011). The German wood products industry leads European Union countries in terms of production of wood products, with about €50 billion in production value from the entire woodworking industries and about €26 billion of that coming from the furniture industry alone (CEI-bois, 2011). In 2007, production of veneer sheets (construction and decorative grades, excluding veneer used in plywood production was 392,825 m^3 in Germany (FAOSTAT, 2011). Evidence from industry trade websites indicate that 33-40 veneer producers and 24-31 veneer trading companies and wholesalers existed in Germany in 2010. Prior to 2010, these sources suggest more than 110 companies producing or trading veneer were in existence in Germany.

The wood products sector is also a large contributor to the employment of United States workers. The United States Census Bureau, which combines the hardwood plywood and veneer manufacturing industries into one value for statistical reporting purposes, reported that in 2007 the hardwood plywood and veneer industries totaled 18,501 workers and 277 active companies (US Census Bureau, 2009). In 2004, the Hardwood Plywood and Veneer Association reported that 37 hardwood decorative veneer companies existed in the United States (Wiedenbeck et al., 2004). However, that number decreased to approximately 26 companies by 2009 (HPVA, 2009), who produced 400,000 m^3 of veneer in that year (FAOSTAT, 2011).

The hardwood veneer industry is important not only to the wood products sectors of Austria, Germany and the United States, but to the economic prosperity of those nations. Austria's forest acreage accounts for 47% of the country's total land area (FAOSTAT, 2009). More than 70% of forests in Austria are privately owned, sustainably managed, and provide an important basis for life for forest farmers (Oesterreichische, 2008). Almost 70% of Austria's wood products are exported, valuing $5.57 billion in 2004 (FAS, 2005). Austria's production and trade patterns for veneer in the last 20 years (shown in Figure 1), suggest that the country's secondary wood products manufacture is a major consumer of veneer. In 2009, Austria exported 22,870 m^3 of veneer sheets (construction and decorative grades) valuing more than $57 million and imported 41,720 m^3 of veneer sheets valuing almost $97 million (FAOSTAT, 2011). In 2009, the production quantity of non-coniferous sawlogs and veneer logs in Austria was 288,466 m^3, down from 418,575 m^3 in 2008 (FAOSTAT, 2011).

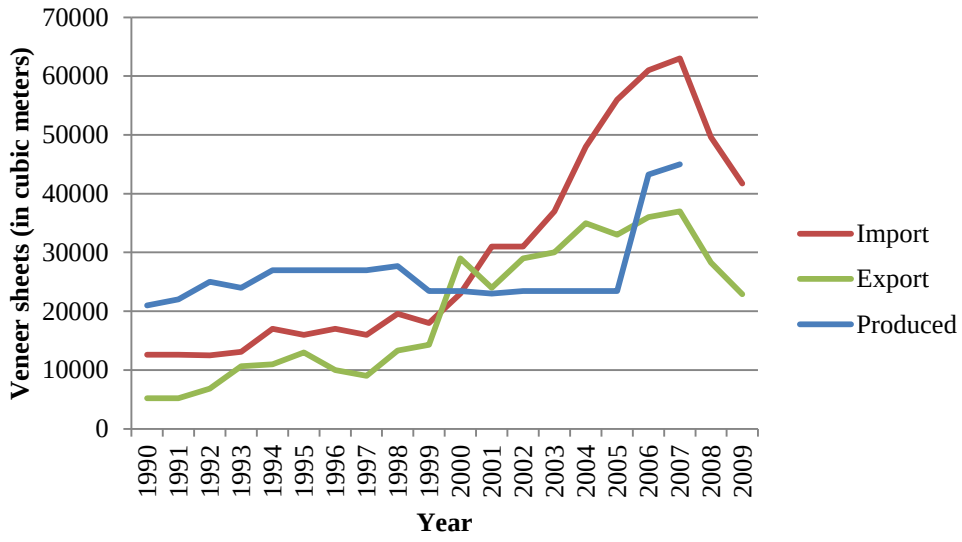


Figure 1. Quantity of veneer sheets produced and traded from 1990 to 2009 in Austria

In Germany, the forest acreage accounts for almost one-third of the country's total land area (FAOSTAT, 2009). Approximately 47% of forest land in Germany is privately held, with the remaining forest acreage split among federal, state, and community forests (BWI[2], 2004). Germany has maintained a long tradition of sustainable forest management, where Programme for the Endorsement of Certification (PEFC) certification was adopted on 65% of the German forest area and Forest Stewardship Council (FSC) certification was adopted on about 5% of forest area (German Timber, 2007). Germany's production and trade flow patterns from 1990 to 2009 can be seen in Figure 2. This data suggests that the German secondary wood products industry is a very strong consumer of veneer produced in and imported to the German market. In 2009, Germany exported 109,000 m^3 of veneer sheets (decorative and construction grades) valuing more than $181 million and imported 156,000 m^3 of veneer sheets valuing more than $178 million. In 2009, the production quantity of non-coniferous sawlogs and veneer logs in Germany was 2.4 million m^3, down from 3.8 million m^3 in 2008 (FAOSTAT, 2011).

The initial scope of this research project included only Austria and the United States. A survey of Austrian hardwood veneer firms would not be statistically robust due to the small number of firms. Due to the similarity of Austrian and German forest industries (i.e., strong internal country consumption of produced and imported veneer), and in terms of convenience (i.e., similar language for surveying and close geographic proximity), the German and Austrian hardwood veneer industries were combined in this research.

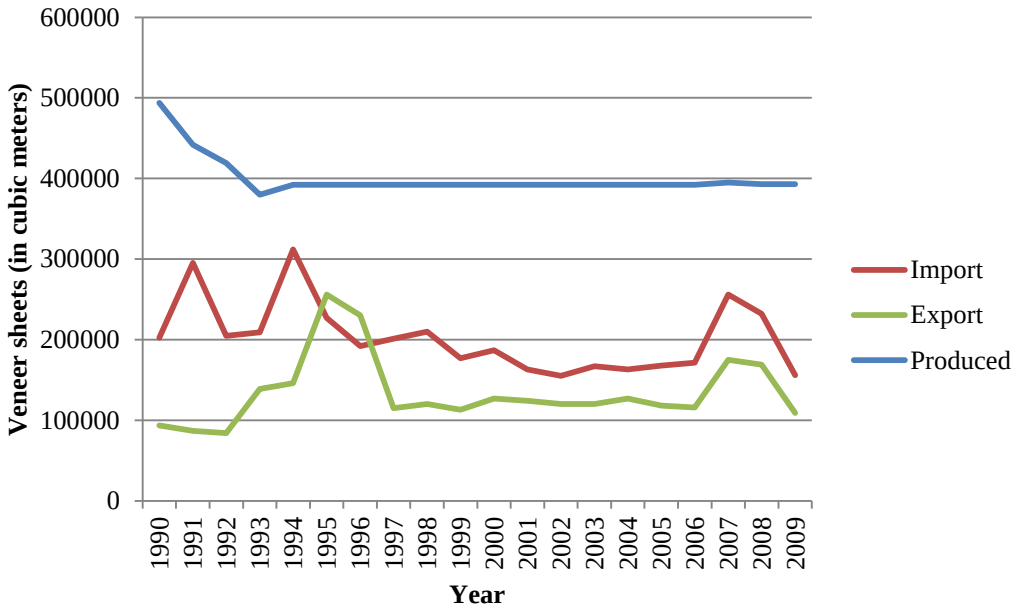


Figure 2. Quantity of veneer sheets produced and traded from 1990 to 2009 in Germany

The forest acreage in the US accounts for 33% of the country's total land area (FAOSTAT, 2009) and is predominantly privately held, with 38% in private non-corporate and 18 % in private corporate ownership (Smith et al., 2009). Eighty-three percent of the private timberland ownership is in the eastern United States, where a majority of the nation's broadleaved deciduous species can be found (Smith et al., 2009). Additionally, 92% of all timber harvested in 2006 was taken from private forest land (Smith et al., 2009). The United State's production and trade patterns for veneer in the last 20 years (shown in Figure 3), suggest that the country is a strong trading nation and has only recently reverted to exporting more veneer than is imported. In 2009, the US exported 195,000 m^3 of veneer sheets valuing $236 million and imported 185,000 m^3 of veneer sheets valuing $195 million (FAOSTAT, 2011). In 2009, the production quantity of non-coniferous sawlogs and veneer logs in the US was 49,326,000 m^3, down from 51,730,000 m^3 in 2008 (FAOSTAT, 2010). Imported and domestically produced veneer supplies the value-adding (or secondary) wood products industries, like door and panel manufacturers, and the sale of veneer logs provides a valuable source of income and product diversification for loggers and sawmills. In the US, there may be as many as 17 industries that supply the hardwood veneer and plywood industries and 69 industries that consume resultant products (researchandmarkets.com, 2009).

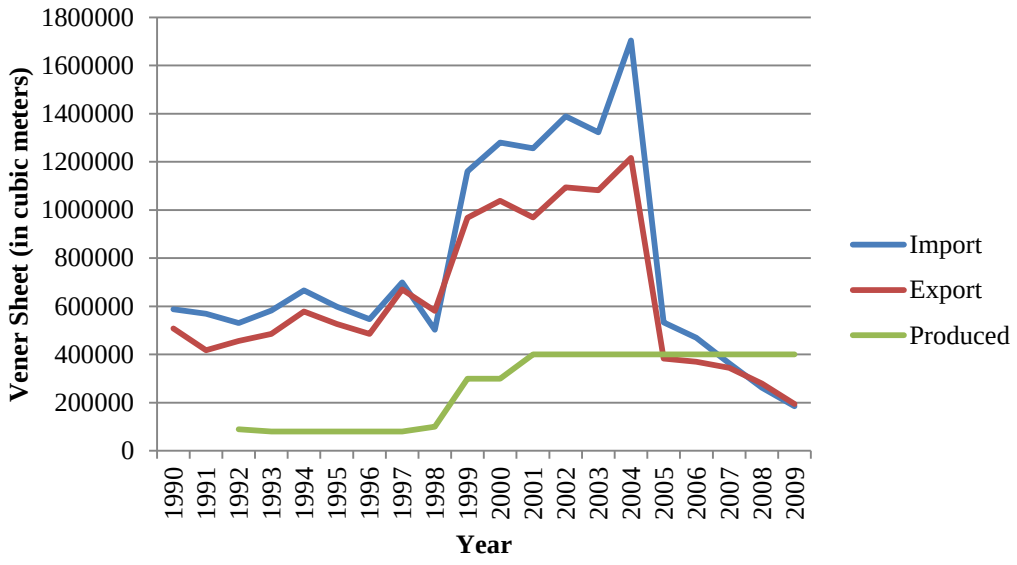


Figure 3. Quantity of veneer sheets produced and traded from 1990 to 2009 in the US

The hardwood veneer industries of Austria, Germany and the United States have different physical characteristics of their immediate environments. Many of Austria's primary trading partners are located adjacent or within close proximity to the country. The primary import and export trading partners for veneer sheets in terms of quantity and value for Austria are displayed in Table 1. In addition, much of the broadleaved tree species, which accounts for 24% (or 676,000 ha) of Austria's total forest types (EEA, 2007), are located in the states of Lower Austria (224,000 ha), Styria (133,000 ha) and Upper Austria (120,000 ha), (Bundesamt für Wald, 2002). Thus, Austrian veneer firms are located in areas of the country to be near to the German border, in the Salzburg area; near abundant resources that aid transportation of raw materials, in Styria and Vienna; and near the eastern production and consuming markets, outside Vienna.

The hardwood veneer industry of Germany relies on export trading partners within close proximity to the country, but imports from farther abroad (as seen in Table 2.) The Foreign Agricultural Service (FAS) (2006) reported that the German market demands North American species (i.e., white oak, hard maple, and black walnut, among others) and relies on tropical timber from countries with legal procurement systems, hence the two of the top trading partners are the US and Malaysia. In terms of their locality within the country, German hardwood veneer producers are primarily located in or near the industrial area (Ruhrgebiet) or on the outskirts of

this area where raw material supplies are abundant (i.e., oak and beech forest types found in the Lohr Region, Bavaria, and Rhineland-Pfalz).

Table 1. 2007 Austrian import and export partners of veneer sheets

Rank	Austria			
	Quantity		***Value***	
	Import	**Export**	**Import**	**Export**
1	Slovenia	Germany	Germany	Germany
2	Sweden	Romania	Romania	Romania
3	Germany	Italy	Ukraine	Italy
4	Romania	Czech Republic	Slovenia	Czech Republic
5	Ukraine	Spain	Slovakia	Spain

Source: (FAOSTAT, 2011)

Table 2. 2007 German import and export partners of veneer sheets

Rank	Germany			
	Quantity		***Value***	
	Import	**Export**	**Import**	**Export**
1	USA	Italy	USA	Spain
2	Brazil	Denmark	Italy	USA
3	Malaysia	Spain	Romania	Italy
4	Sweden	Czech Republic	Poland	Austria
5	Poland	China & Poland (Tie)	Czech Republic	United Kingdom

Source: (FAOSTAT, 2011)

In contrast, the United States has had to adapt to a broad resource base, coupled with a large domestic demand for veneered products and primary trading partners that span 5 continents. The primary import and export trading partners for veneer sheets for the United States are shown in Table 3. The US consists of 33% forested area (FAOSTAT, 2009), with the eastern United States boasting the only domestic source where all the major broadleaved species suitable for veneer production are present (Smith et al., 2009). Thus a majority of the firms clustered production facilities in Indiana (Indianapolis and New Albany), Kentucky (Louisville), and Ohio (Cincinnati) to be closer to these resources and reduce cost and time of transport (Callahan, 1990). Eventually, to follow the progression of the furniture industry, North Carolina (High

Point) also developed a hotspot for veneer sales facilities (Callahan, 1990). Other firms could be found peppered throughout the Midwest and Eastern states (Callahan, 1990). In addition, some of the veneer produced domestically, stays in the US. In 2008, total US domestic demand for the hardwood veneer and plywood industries was approximately $4.7 billion (researchandmarkets.com, 2009). Thus, the US's trade structure differs greatly from Austria's in part due to geographic proximity to international trading partners.

Table 3. 2007 US import and export partners of veneer sheets

Rank	United States			
	Quantity		***Value***	
	Import	**Export**	**Import**	**Export**
1	Canada	Canada	Canada	Canada
2	Brazil	China	Germany	Germany
3	Italy	Mexico	Brazil	Spain
4	Ghana	Germany	China	China
5	China	Spain	Italy	Italy

Source: (FAOSTAT, 2011)

Technological progression has had a great impact on the development of the hardwood veneer industry. The progression occurred later in the US than in Europe, with the first veneer saw being developed in 1805 in England and the first horizontal slicer coming about one year later, while the first veneer slicer wasn't invented until the early 1830's in the US (Callahan, 1990). An important phenomenon in veneer slicing technology was the alteration of machines to slice varying thicknesses. One extreme example is the Marunaka Tekkosho company of Japan, who produced a veneer slicer that could slice thicknesses of 0.3mm-3mm one year after development of a super surface planing machine, and thick-slicing machines that could slice thicknesses of 3mm-13mm in 1993 (Marunaka, 2005a; Marunaka, 2005b). Other veneer slicing machine manufacturers (such as Cremona and Capital Machines) also sell machines that can adapt to the thickness demands of the consumer. The Japanese market can accommodate veneers sliced at 85-120 sheets/inch, the German market uses veneers sliced at 45-55 sheets/inch, and the American market uses veneers sliced at 32-42 sheets/inch (Blackman, 1993). This technology provides firms an opportunity for product diversification, but also creates a competitive advantage to those markets that use veneer more efficiently and can pay higher prices for quality veneer logs (Blackman, 1993).

The progression of technologies outside the hardwood veneer industry has also increased the opportunities for firms across the globe to gain a competitive advantage. For example, supply chain technologies have increased efficiencies in inventory management from procurement to sales of veneer firms. Logs receive a bar code upon purchase, and then veneer is tracked through production with bar coded tags and can be quickly retrieved from production or inventory with this technology. Firms like SAP, Kleistronik, and TDS supply to hardwood veneer firms across the globe, while some firms have created their own systems (Blackman, 1993). Even technologies like the internet have impacted the way hardwood veneer industry firms conduct business. Photos of veneer can be taken after veneer is graded and uploaded to the company's or a third party's website to aid veneer sales. Customers can inform veneer sales agents if they are interested or not in the veneer from certain logs to save time and cost for both the customer and veneer producer.

Despite these technological advances, the veneer industry has experienced consolidation of firms, business closures or conversions to sales-only facilities via contracting veneer slicing to other firms. Industry consolidation may be encouraging remaining firms to seek new sources of competitive advantage throughout the production process. The process of veneer production consists of log selection, debarking, flitching, steaming or cooking, planing, slicing, drying, clipping, costing, sorting and selling (Lutz, 1977; Furnierwerk, 2006). Each step in this process provides an opportunity for value to be added to the final product and for gaining a competitive advantage over other firms (Rother and Shook, 1999). Additionally, numerous experts argue that each step in the production process of a product also provides an opportunity for innovation, and that innovation can lead to creating a competitive advantage for the firm.

The veneer production process begins with log selection. Veneer logs are purchased as standing timber or as logs from logging companies, log brokers, sawmills, and other veneer mills (Wiedenbeck et al., 2004). Logs are selected for veneer production based on an evaluation of exterior characteristics assumed to portray a certain quality that the firm's customers desire (Lutz, 1977; Cassens, 1992; Wiedenbeck et al., 2004). Veneer quality log supplies are found in the temperate and tropical regions of the world and tend to change in availability. For example, a log export ban in Gabon will impact the market availability of exotic log species like zebrawood, sapele and ebony (ITTO, 2009a). Additionally, there are various assumptions and

realities in terms of geographic regions where suitable veneer of certain species originates. For example, some log procurers in the United States argue that hard maple from Maine exhibits good color and minimal sugar track or that walnut from Missouri and Illinois commonly has red streaks (Wiedenbeck et al., 2004). These issues generally cannot be amended during the production process, making procurement of high quality logs of utmost importance.

Furnierwerk Fritz Kohl GmbH & Co. KG (2006) summarized the subsequent steps involved in the manufacturing process, found in Figure 4. The production methods used by a firm in each of these steps are an opportunity for value creation and innovation. For example, the cooking schedules of flitches vary by species, and firms have developed precise cooking schedules that work best with their production process to reduce production defects and produce veneer with a consistent look (in terms of color, thickness, etc.) Another example is plant layout of machines used to complete the steps in the production process. Some firms have created a competitive advantage by having veneer dryers that accept veneer sheets directly from the slicers. This prevents the need for a set of workers to stack the veneer as it comes off the slicer, and another set of workers to load the veneer sheets into the dryer.

Following the manufacturing process, veneer is costed, or evaluated and priced, and sorted into grades (Furnierwerk, 2006). Most companies use a grading line similar to a version patented by Emil Herman for the plywood industry (Herman, 1970), which consists of a series of conveyor belts that move most or all of the bundles from one log in front of a grading station. A veneer grader evaluates the bundles from each log based on quality, dimension and intended use (i.e., door, panel, or furniture); and the bundles are sorted into various grades (Furnierwerk, 2006; veneernet.com, 2009). Achieving consistency of color, length, characteristics like knots and

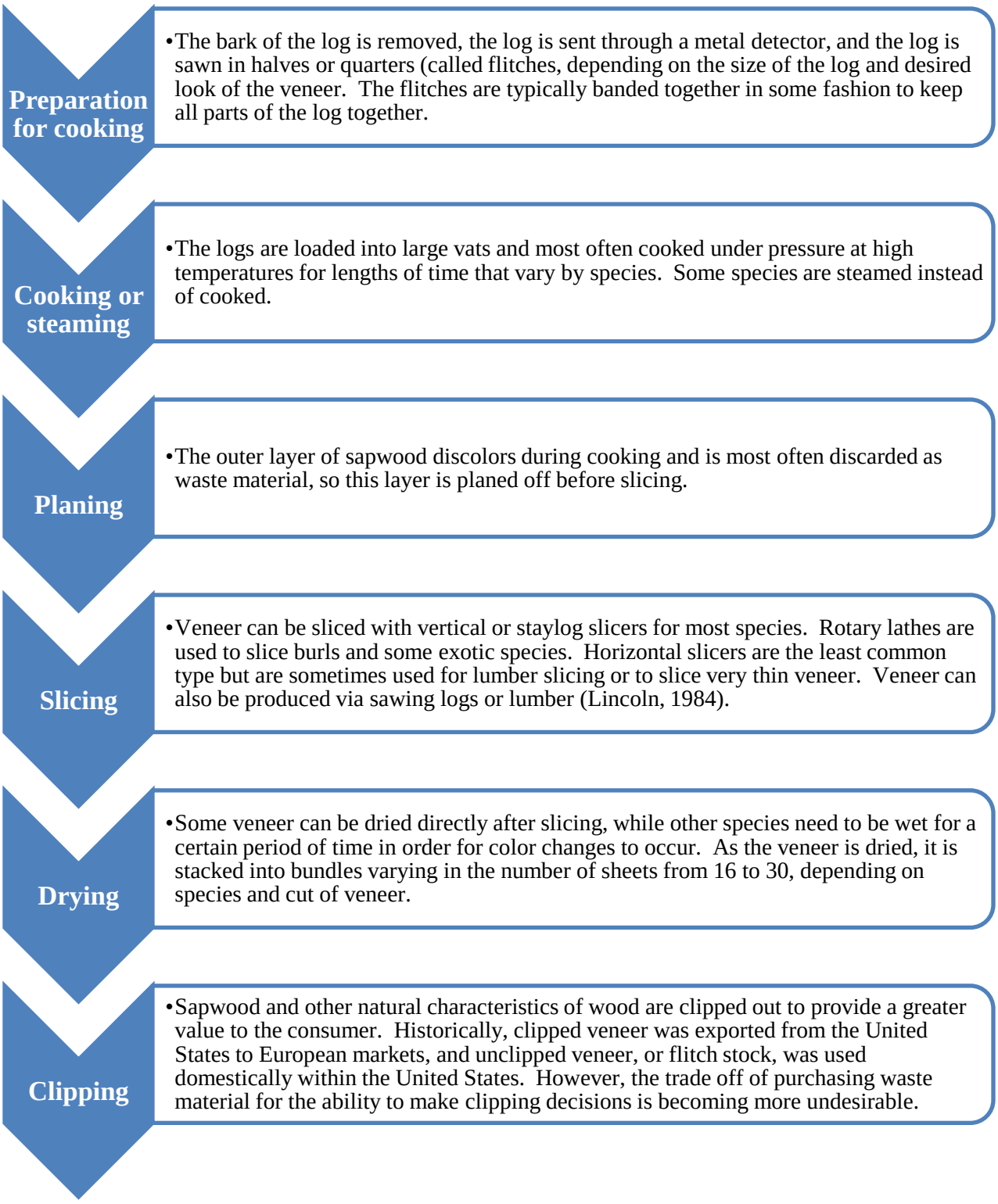


Figure 4. Description of veneer manufacturing process

mineral, and grain pattern within each grade is important (Schramm, 2003), so an attempt is made to keep as many of the bundles from one log in the same grade as possible.

An industry standard for veneer grades was established under specific guidelines set forth by the American National Standards Institute, Inc. (ANSI) in 2000 (Schramm, 2003). These voluntary standard grades can be utilized across all industry firms (Schramm, 2003), but most firms have additional grades or sortations based on their customers' needs for the applications of the veneer's intended use (Furnierwerk, 2006). Additional standards were created by the International Wood Products Association (IWPA) in 2000 to address wood veneers imported to North America (IWPA, 2000). In Europe, the German Institute for Standardization (DIN) established general standards for veneer (DIN 68330:1976 08) as well as veneer thickness standards (DIN 4079:1976 05) (DIN, 1976a; DIN, 1976b). Surface grades were also established by the European Committee for Standardization (EN) for hardwood plywood panels (EN 635-2:1995 D) and in general, for panels (EN 635-1:1994 D) (CEN, 1994; CEN, 1995). Companies use these veneer grades and standards to establish price/quality relationships that aid in veneer sales (veneernet.com, 2009).

It is imperative at this stage for the veneer producer to know the product and service demands of the customer. The forest products industry has traditionally focused on products as opposed to consumer needs (Juslin and Hansen, 2002). Today, not only is it important for veneer firms to create customer-specific grades; but providing the right species, in the right qualities and quantities, at the right price, to the right location that meets the customers' needs without requiring return of damaged goods or unnecessary delays to receive a correct invoice for the order are now an expectation of business (Bowersox et al., 2002a). Firms that can exceed these expectations by providing solutions to new and unarticulated needs at a reasonable cost that generate value for the consumer create a competitive advantage (Bowersox et al., 2002b; Snyder and Duarte, 2003). For example, several companies exhibiting at the interzum 2009 fair in Cologne, Germany, advertised their capability of laminating one side or applying a paper backing to veneer sheets. This service or product variation adds cost to the final product, yet provides a significant enough value to the consumer that makes it a worthwhile service.

The markets for various products or services may change temporally, globally, and preferentially. For example, prices for logs delivered to Indiana veneer mills changed anywhere

from -29.2 % to 104.4% after only one year (see Appendix A), (Hoover and Gann, 1999; Hoover, 2008), thus increasing variability in price of the final product. Prices for veneer species from Ghana stayed relatively stable from 2008 to 2009, but a ban on log exports and limited infrastructure to absorb production capacity could cause an increase of these prices into the future (see Appendix B), (ITTO, 2009a; ITTO, 2009b). Additionally, understanding the market sensitivities for various attributes of veneer around the globe is a vital firm activity (Wiedenbeck et al., 2004) and can be an important source of competitive advantage.

In a perfectly competitive market condition, all buyers and sellers would have equal information and would be equally satisfied with the results of an exchange. However, the reality in the veneer market is that product variability, disorganization of the market and the lack of information (caused in part by the use of agents, distance separating buyers and sellers, and buyer strength) deteriorate the possibility for perfect competition (Callahan, 1990). Thus, in a market characterized by dynamic competition, growth results from innovations arising from competition (Ellig, 2001). Characteristics of the veneer industry (like information asymmetry, unique resources, and product differentiation) lead to the use of the resource-advantage theory[1] of competition, which stresses the importance of market segments for growth (Hunt, 2007). In this view, creation or exploitation of new markets are critical for firm growth.

Given the multiple opportunities for veneer firms to add value at various steps of the procurement, production, and sales processes, a decision must be made regarding how the firm will be organized both internally and within the external network of industry firms to accomplish these tasks. An IBM CEO described this scenario well when they stated, "Products and services can be copied; the business model is the differentiator" (IBM, 2006).

In addition, an Accenture/Economist Intelligence Unit survey of 600 senior executives identified the pursuit of line extensions as opposed to developing new business models as a barrier to innovation (Alon and Chow, 2008). In this research project, a business model is defined as:

[1] Ellig (2001) identifies the resource-advantage theory as the application of Schumpterian (i.e. firms compete not on price and output, but on innovation in 5 areas), evolutionary (i.e. firms compete on the basis of efficiencies of routines), and Austrian (i.e. firms compete on the basis of identifying new resources and better ways of satisfying consumers, and their profits are a reward for being observant in an uncertain environment) insights to strategic management. Innovation is a key component of competitive advantage in all three theories.

> a set of activities a firm performs, how it performs them, and when it performs them as it uses its resources, given its industry, to create superior customer value and put itself in a position to appropriate that value (Afuah, 2004).

Though no literature describing business models specifically for the veneer industry exists, three forms were identified through extensive literature review and company surveys conducted by IBM as industry model innovation, revenue model innovation, and enterprise model innovation (Giesen et al., 2007). Industry model innovation refers to innovating the 'industry value chain', which can involve horizontal moves into new industries to leverage core competencies, redefining existing industries, or even creating new industries (Giesen et al., 2007). Revenue model innovation involves reconfiguring product/service/value mix or price offerings to generate revenue. Afuah (2004) argues that because a revenue model does not consider overall profits (i.e., costs are not considered) that it is not a business model. Thus, in this research, revenue models classified under this category also consider costs and are called profit model innovations.

Finally, enterprise model innovation innovate both enterprise structure and its role in new and existing value chains (Giesen et al., 2007). Enterprise model innovation can be achieved through supply chain integration, specialization on core competencies, or external collaborations (Giesen et al., 2007). Each of these business models can be found in varying forms in the veneer industry, can lead to a competitive advantage, and are of interest in this study.

Business models or organizational forms dictate how a firm allocates its resources across business units or a set of businesses (in the case of corporate forms). One of the ways a firm does this is via scale and scope decisions. For example, Porter (1985) described four dimensions of scope apparent in business as:

1) Segment scope refers to the product varieties produced by the firm to serve a set of buyers.

2) Vertical scope is the proportion of in-house activities versus those allocated to independent firms.

3) Geographic scope refers to the regions, countries or groups of countries a firm uses a strategy to compete within.

4) Industry scope is described as the industries the firm uses a coordinated strategy to compete within.

Hardwood veneer industry firms in both the United States and Austria are very similar in terms of the variety of scale and scope of firms. For example, segment scope can refer to a custom-slicing firm, a traditional production firm or a trading firm; and can differ in terms of the products produced as well as the customers served. A custom slicing firm is a firm whose customers are typically veneer trading firms, but can also be other types of firms using veneer as a means of product differentiation who outsource its production. The raw materials used in custom slicing operations are supplied by the customer, while the custom slicing firm provides the technology and know-how to produce quality veneer for the customer. Custom slicing firms will have different customers, for example, than a veneer trading company. A veneer trading company is a firm that does not manufacture veneer. This firm either buys veneer from a company via custom slicing arrangement or trades veneer purchased from other veneer traders or production firms. The veneer trading firm structure does not include the sales outlets owned and operated by production firms. Veneer log brokers and veneer sales agents are also considered different types of segment scope.

In terms of vertical scope, the ownership of forest land from which logs are harvested to supply the hardwood veneer firm's manufacturing is one type. Other examples include purchase of a customer firm producing furniture or beginning a spliced face manufacturing operation in order to sell spliced faces to the panel industry.

Geographic scope is also a common decision veneer firms must make to create or sustain competitive advantage. Production and sales operations (who procure their own logs, produce them, and sell them to secondary wood products manufacturers) may prefer to deal with local, regional or international markets for procurement, production, and/or sales. Scale is typically a factor that differentiates production and sales operations from one another, and is also closely associated with geographic scope. Many of the firms dealing with local markets only are small- to medium-sized enterprises, while international firms typically are larger firms, groups or corporations.

In terms of industry scope, some firms use veneer production as a form of product diversification, where it is either their primary product or an additional product offered by their firm. Some common industries associated with decorative veneer production are plywood or other panel type production.

Hoover and Gann (1999) found that sawlog inventory of the northeastern US harbors less than 1 percent of veneer quality logs, and Wiedenbeck, et. al. (2004) determined that these logs command 1.5 to 6 times the price of grade 1 sawlogs. Yet, despite the importance of the hardwood industry's capability of conserving the highest quality trees in the forest for their most appreciated uses, very little research has been conducted to understand the idiosyncrasies of this industry. The primary research areas in this field have been log quality and grading studies (Harrar, 1954; Bethel and Hart, 1960; Henley et al., 1963; Harrar and Campbell, 1966; Lutz, 1977; Cassens, 1992; Wiedenbeck et al., 2004; Cassens, 2004a), historical accounts (Callahan, 1990), species guides (IUFRO, 1973; Furnierwerk, 2006), technical or processing guides (Keylwerth, 1965; Cropp, 1966; Lutz, 1977; Fuchs, 1981; Lincoln, 1984; Schramm, 2003; Cassens, 2004b; Wagenfuehr et al., 2006), and public market data from international or national sources (FAS, 2009; US, 2009; ITTO, 2009a; FAOSTAT, 2010), and various state sources within the United States. To date, there has been no published research on innovation strategies in the hardwood veneer industry or the impacts to them.

Investigation of Innovation Strategies

In order to understand innovation strategies and their importance to the firm, a definition of innovation itself is necessary. Theorists define innovation in various ways, many of which build upon previous definitions.

Innovation can be:

> an idea, practice or object that is perceived as new by an individual or other unit of adoption (Rogers, 1962).

By incorporating the idea of deliberate innovation, a further definition of innovation is:

> the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, organization or wider society (West and Farr, 1990).

More recently, from a management perspective, an innovation might be:

> a marked departure from traditional management principles, processes and practices or a departure from customary organizational forms that significantly alters the way the work of management is performed (Hamel, 2006).

The basic concept described by these definitions is that innovation is the creation and implementation of something new that brings about positive changes in organizations. Many theorists agree that in order for an idea to be 'new' or an 'innovation', it needs to be the first implementation of its kind by a firm in an industry, not necessarily a creation of that firm (Zaltman et al., 1973; Rogers, 1995).

Austrian economist Joseph Schumpeter was one of the first and perhaps most widely recognized theorists on innovation since the beginning of the field of study, with his work on economic development published in 1934 and business cycles published in 1939. Schumpeter (1939) determined the difference between invention and innovation, where the former is creation of a new idea and the latter involves adoption or implementation of this idea within an organization. Dechamps (2008) further explains this as the need for two leadership styles in organizations, which oftentimes results in two individuals occupying these roles; one style to develop inventions and one style to lead the implementation of the invention through the organization (especially through production and sales). Schumpeter (1939) also described the necessity for a driving force to bring about innovation, which he deems to be the entrepreneur, by creating new combinations of five important dimensions: new sources of supply, new methods of production, new markets, new organizational forms and new products or services.

Schumpeter (1939) defines these five dimensions as follows:

1) *New products or services* – a product or service that consumers are not yet familiar with or a new quality of a good or service.

2*) New methods of production* – a method of producing a good that has not yet been tested by experience in a manufacturing environment. This method need not be discovered by the firm or manufacturing branch, and can also be a new way of handling a commodity commercially.

3) *New markets* – opening a market into which the firm or manufacturing branch of the country in question has not yet entered, regardless whether or not this market previously existed.

4) *New source of supply* – seeking a new source of raw materials or half-manufactured goods, regardless whether this source existed before or had to be created.

5) *New organizational forms* – carrying out a new organization of any industry, like creation or breaking up of a monopoly position.

Some theorists have changed the names of these five dimensions to suit their needs. For example, methods of production are often referred to as 'business processes', organizational forms are called 'business models', and sources of supply are often described as 'procurement sources'. In this work, Schumpeter's terms are often used interchangeably with the terms of other theorists, yet the meaning remains as Schumpeter defined it.

Business theorists have also discerned various dimensions that characterize innovation. Damanpour's (1991) meta-analysis of determinants and moderators to organizational innovation identified three dichotomies present in the literature that characterize innovations: technical/administrative, product/process, and radical/incremental. Schumpeter's five dimension model of innovation encompasses the dimensions identified by these dichotomies. The technical dichotomy includes products, services, and production process technology, while the administrative dichotomy involves organizational structure and administrative processes (Damanpour, 1991). In relation to Schumpeter's five areas of innovation, these elements can be described by products, services, methods of production, organizational forms, and methods of production or organizational forms, respectively. On the product/process dichotomy, products represent products and services, while processes represent input materials, task specifications, work and information flow mechanisms, and processing equipment (Damanpour, 1991). In relation to Schumpeter's five areas of innovation, these elements represent products, services, sources of supply, organizational forms, methods of production, and methods of production,

respectively. Radical and incremental innovations are fundamental or few departures from normal work processes, respectively (Damanpour, 1991).

Additional theories of innovation exist that describe a fewer or greater number of dimensions. Three dimensions of innovation provided by Boer and During (2001) are products, processes and organizational innovations, and are focused on innovativeness of firms. Four dimensions of innovation are used in the Oslo Manual (OECD, 2005) and agreed to by the Organization for Economic Co-operation and Development and Eurostat, of the European Commission. These four dimensions are product innovation, process innovation, marketing innovation, and organizational innovation, which are all meant to be focused on activities of the firm as opposed to an industry. In addition, a 12-dimension 'innovation radar' was developed by Sawhney, Wolcott and Arroniz (2006) to help businesses innovate their 'who, what, where and how'. These dimensions are offerings, platform, solutions, customers, customer experience, value capture, processes, organization, supply chain, presence, networking and brand (Sawhney et al., 2006), and are also aimed at business operations. None of these definitions is proposed to be focused on a broader context than the business itself. Schumpeter's five dimension theory of innovation has been used in studies of the health services sector (Windrum and Garcia-Goni, 2008), service firms in general (Flikkema et al., 2007) and the biotechnology industry of Sweden (Mondal and Espana, 2006), to name a few.

Schumpeter's dimensions extend beyond the boundaries created by the dimensions of business theorists and provide a broader view of innovation that is conducive to studying innovation from an industry-wide and country perspective. His dimensions are more than measurements of the capacity of an organization to innovate (i.e., innovativeness), they are dimensions that describe activity areas where the firm can be innovative. Points of departure and similarities exist from Schumpeter's five dimension theory of innovation to economic theories, supply chain theory, and value chain theory.

In terms of economic theory, Schumpeter is noted as one of five economists whose work contributed to the creation of modern macroeconomics (Hansen, 1951). Schumpeter's works (1939; 1942) identified two different industrial innovation patterns. The first pattern (Schumpeter Mark I) consists of innovations of small firms in competitive industries spurred by the work of the entrepreneur. In a later work, Schumpeter (1968) went on to describe the role of

the entrepreneur to generate innovations that ameliorate general economic conditions of recession and depression. The second pattern (Schumpeter Mark II) consists of large corporations in oligopolistic industries who innovate through R&D ventures. Empirical works have been undertaken to discern these patterns within certain industries, and one overall conclusion suggests that these patterns can coexist in the same industry at a given time (Keklik, 2003). One hypothesis suggests that industries progress through stages or life cycles, and that one pattern (Schumpeter Mark I) precedes the other (Schumpeter Mark II) (Keklik, 2003). In a mature industry, like the wood products industry, it has been shown that both of these patterns do co-exist (Wagner and Hansen, 2005). The recent housing market crash and subsequent global economic crisis have created the prime economic environment to observe Schumpeter's theories in action.

Theorists claim that numerous innovations stem from supply chain relationships (Lundvall, 1985; Håkansson, 1987), namely from buyer-supplier relationships (Dodgson and Rothwell, 1994; Millson et al., 1996; Robertson and Gatignon, 1998; Sivadas and Dwyer, 2000; Roy et al., 2004). The creation of combinations using Schumpeter's five dimensions can create interfaces for buyers and suppliers to interact that may induce innovations. For example, an alliance (i.e., new organizational form) of two firms to develop a new product may cause suppliers from one firm and buyers from another firm to interact in more intimate ways. The sharing of information and knowledge may aid in innovation generation beyond the new product development. New methods of production may arise by the sharing of knowledge in this alliance relationship.

Lastly, similarities exist between Porter's value chain and Schumpeter's five dimensions of innovation. In the activity-based view of the firm, or the value chain perspective, understanding how value is created for the consumer is the key to successful firm performance (Porter, 1985). Similarly, Schumpeter stated that the meaning behind every economic action is the satisfaction of wants derived from a utility or system of values of the consumer (Schumpeter and Opie, 1968). Porter's (1985) value chain is a strategic analysis framework that can be used to improve a firm's competitive position. For example, Porter (1985) views the structure of an organization from top down as firm infrastructure, human resource management, technology development, procurement, and the value chain. The configuration and coordination issues associated with these value creating activities can be considered creating new organizational forms under

Schumpeter's definition. In other words, the structure of a firm, including human resource management is considered to be the firm's business model by Schumpeter's definition. Technology development is an activity that can be performed across all dimensions of Schumpeter's model, and is therefore considered a factor that influences Schumpeter's five dimensions. The procurement value-adding activity is a part of Schumpeter's sources of supply dimension, and is a necessary dimension of innovation for an organization because of its role in the supply and value chains. Porter's value chain rounds out the remaining similarities with the elements of Schumpeter's five dimension model. Logistics (inbound and outbound) and operations are parts of methods of production, marketing and sales are new markets, and service is part of products and services. New combinations of many of Porter's value chain elements could produce the innovations that Schumpeter envisioned by combinations of his five dimensions. Both Porter and Schumpeter express the need for trade-offs in the development of the dimensions used in combinations to create innovations and the detriment of those dimensions left unused. Both Porter and Schumpeter's models include an element of margin produced by differences in the cost of production and the price paid for goods or services.

Various studies exist regarding innovation in the wood products industry. General studies on innovation include such issues as innovation in large versus small companies (Wagner and Hansen, 2005), managing organizations to create a culture of innovativeness (Crespell and Hansen, 2008), exploration of innovation in China's furniture industry (Cao and Hansen, 2006), an industry R&D agenda for wood and wood composites (Showalter et al., 2003), and innovation diffusion and public policy issues of biomass heating systems in Austria (Madlener, 2007). Additionally, Kaplinsky and Readman (2005) studied the measurement of product innovation using international trade data for the furniture industry. A project by the Fachhochschule-Salzburg in Kuchl, Austria, explored the possibilities of using veneer in a variety of applications departing from the traditional uses of veneer for furniture, panels, doors, and flooring (Petutschnigg et al., 2008). Hovgaard and Hansen (2004) and Quesada-Pineda (2010) conducted research most specific to identification of the dimensions of innovativeness. Hovgaard and Hansen (2004) determined that the three dimensions identified by Boer and During (2001) can be used to describe the wood products industry: product, process and a catch-all dimension called 'business systems'. Quesada-Pineda (2010) determined that the four dimensions identified by the OECD, namely, processes, products, marketing and organization, could be used to

characterize the types of innovation within the wood products industry. Despite the number of factors that can be used to characterize innovation types present in the forest products industry, a study on impacts to innovation strategies would be a valuable contribution to current wood products industry knowledge. In addition, a study that included the hardwood veneer industry, a sector not currently covered under the work of other researchers, would also be a valuable addition to the literature.

Given that the focus of this study is the entire hardwood veneer industries of Austria and the United States, use of the model of innovation provided by Schumpeter is very appropriate. Previous literature on the hardwood veneer industry has shown that the five dimensions Schumpeter described are clearly present and relevant forms of innovation. External firm factors have been theorized and proven to impact all five of Schumpeter's dimensions of innovation (as will be described in subsequent pages of this document). Therefore, the definition of innovation that will be used in this study is:

> to begin or introduce a source of supply, method of production, market, organizational form or product or service that has not previously been used by the firm in question.

The importance of innovation in developing a competitive advantage has already been noted. However, having a strategy for innovation is perhaps more important than innovation itself. In an Accenture 2002 survey of CEO's, Kambil (2002) reported that two-thirds of respondents cited having a clear innovation strategy as the primary factor involved with achieving and sustaining a competitive advantage. Interviews involved with this study provided the insight that lack of a clear innovation strategy was a concern to CEO's, particularly because it prevented prioritization of the organization's innovation activities (Kambil, 2002). Inefficient strategic development of the organization would result, as multiple organizational groups may be striving toward the same strategic goals due to a lack of coordination among these groups (Kambil, 2002).

The term 'innovation strategy' has developed only recently in the literature and few authors have attempted to define it (Sauber and Tschirky, 2006). Sauber and Tschirky (2006) completed a comprehensive literature review of the concept of innovation strategies in research and aggregated the main ideas to produce the following definition:

> An innovation strategy sets direction, focuses efforts, allows the design of an organization and ensures constancy in the innovation system while considering integral innovations, innovation barriers, and the degree of newness of the innovation as well as the required innovation relevant knowledge.

Sundbo (1998) identified three paradigms of innovation strategies, namely entrepreneurial, technology-economic, and strategic innovation. The entrepreneurial theory is based on the premise that innovative individuals within the organization spur innovations, regardless what type (i.e., product, market, organizational form, etc.), (Sundbo, 1998). The technology-economic theory is based on the premise that technological innovations (i.e., product and production method innovations) spur economic growth, primarily a result of incremental innovations developed through R&D ventures (Sundbo, 1998). The strategic innovation theory (based on marketing theory, service management theory and strategic theory) identifies strategic planning and strategic behavior at the management level in response to consumer demand as the paramount factors involved in innovation creation in all areas of innovation (Sundbo, 1998). Sundbo (1998) theorizes that a new innovation system, like the three described, develops with every new economic cycle (called Kondratiev cycles, named after the Russian economist). Under this theory, the entrepreneurial theory of innovation begins when a market is in the process of formation, the technology-economics theory is relevant for established but unexploited markets, and the strategic theory of innovation is used in saturated or rapidly changing markets (Sundbo, 1998). Given the hardwood veneer industry's position as an established, saturated market, the strategic theory of innovation is of primary importance in this work.

Various types of innovation strategies exist, depending on the level of aggregation (company, functional unit, or product), (Sauber and Tschirky, 2006). This work focuses on the industry level of aggregation for a country as measured by representative companies within that country. Company level innovation strategy types that exist in the literature are provided by Abernathy and Clark (1985), Cooper (1985), Zahn (1986) and Afuah (2009). The innovation strategy types proposed by Cooper (1985) are intended for new product development ventures, and are described as technologically driven, balanced focus (i.e., firm focuses on new products, new technologies, new markets), technologically deficient, low budget/conservative, and high budget/diverse strategies. The innovation strategy types proposed by Zahn (1986) focus on

creation of a competitive advantage through technology adoption, and are described as pioneer, imitation, niche, and cooperation strategies.

The innovation strategy types proposed by Abernathy and Clark (1985) follow both technology/production and market/customer continuums, and are described as niche creation (i.e., using existing technologies to open new markets), architectural (i.e., new technology that is used on new products or in new markets), regular (i.e., using existing technology on existing markets and products) and revolutionary (i.e., using new technology on existing products and markets) strategies. And finally, the innovation strategy types proposed by Afuah (2009) follow two continuums, product versus resource/capability obsolescence. Afuah (2009) describes these strategies as position-building (i.e., existing resources and capabilities are used to create new products that renders existing products obsolete), regular (i.e., use of existing resources to build new products or improve position vis-à-vis competitors), resource-building (i.e., using new resources and capabilities to create new products that improve competitive position) and revolutionary (i.e., new resources and capabilities are used to create new products that render existing products obsolete and position vis-à-vis competitors is highly competitive).

One of the objectives of this research is to identify what types of innovation strategies are in use in the hardwood veneer industry. The strategy types proposed by the aforementioned authors will be considered during innovation strategy identification. However, the strategy types proposed by Cooper (1985) and Zahn (1986) seem to express the two continuums developed by Abernathy and Clark (1985) and Afuah (2009). Namely, Cooper's new product development strategy seems to express the market/customer continuum from Abernathy and Clark, while Zahn's technology adoption strategy seems to express the Abernathy and Clark's technology/production continuum. Given that the focus of this research covers both innovations in products and services, as well as resources and methods of production, the innovation strategies of Abernathy and Clark (1985) and Afuah (2009) seem most relevant and will be combined for this study.

The combined innovation strategy types will follow continuums of new customers/markets and new resources/capabilities. Following the customer/market continuum, by using existing resources/capabilities to serve existing customers/markets, the firm would be following a regular strategy. In the same respect, use of existing resources/capabilities to serve new

customers/markets would result in the firm using a niche innovation strategy. Following the resources/capabilities continuum, if the firm uses new capabilities to serve existing customers, the strategy in use would be called resource-building. And if the firm uses new capabilities to serve new customers/markets, the firm would be using a revolutionary strategy. If we envision a coordinate plane divided into quadrants by two axes that represent our continuums, each of the four innovation strategy types would occupy a quadrant. These four innovation strategy types will be tested in this study.

In order to identify innovation strategies, an understanding of strategic planning and strategic behavior is necessary (Sundbo, 1998). A strategic plan is "a consciously intended course of action, a guideline (or set of guidelines) to deal with a situation" (Quinn, 1999). Mintzberg (1978) defined strategy as a 'pattern in a stream of decisions', where decisions are a commitment (usually of resources) to action. Strategic behavior can then be defined as a 'pattern in a stream of actions' (Quinn, 1999). Juslin and Hansen (2002) stated the forest industry firms can use vision, mission and values as a 'guiding light' for strategy development of the firm. In this work, a firm's vision, mission and values will be explored to identify a strategy for firm innovation in each of Schumpeter's five areas of innovation. In addition, management actions will be used to further identify the innovation strategy of a firm.

Mintzberg and Waters (1985) also discuss strategies of an organization along a continuum from purely deliberate to purely emergent. For a strategy to be purely deliberate, three conditions must be met: 1) precise intentions must have existed in the organization so that there was no doubt the actions intended from the strategy; 2) the strategic intentions must have been shared by all actors in the organization; and 3) the strategic intentions must have been realized exactly as intended (meaning no interference from external firm factors), (Mintzberg and Waters, 1985). Purely emergent strategies are the opposite; they lack order (Mintzberg and Waters, 1985). Since it is nearly impossible to find these pure strategies in real-life situations, strategies typically lie somewhere along a continuum. Innovation strategies of hardwood veneer industry firms will be identified in this study as either 'deliberate' or 'emergent'. It is particularly useful to make this distinction because environmental forces may impact deliberate strategies to change their course of action, and it is possible that strategies deliberate enough may have the capacity to change their environment (Galbraith, 1967). In addition, recommendations can be created for

firms with 'no' innovation strategy, or mostly emergent forms, to help them develop strategies that are more deliberate.

External Firm Factors Impacting Innovation

Christensen, et. al.(1973) argue that "no matter how secure a company's position, obsolescence of strategy is a continuous threat." In order to develop an effective strategy, it is important to perform environmental scanning activities that include factors external to the organization (Christensen et al., 1973; Barnes, 2001). Typically these types of environmental scanning activities are performed when a business venture is in the planning stages. However, Fleisher and Bensoussan (2002) stress the effects of the broader organizational environment on competitive performance during the life of the firm. Management theorists have determined that good environmental scanning extends beyond the threat of competitors and substitute products to factors social, technological, economical, political (Christensen et al., 1973) and ecological (Andrews, 1999) or natural (Afuah, 2009) in nature. These factors are commonly referred to as STEEP factors. Porter (1990) refers to these factors as shifters of competitive advantage within an industry because of their ability to cause of innovations. If we imagine a target, where the bullseye is the firm's internal operating environment and the second ring out is the operating environment consisting of customers, suppliers, competitors and partners, the STEEP factors would occupy the outermost ring (Fleisher and Bensoussan, 2002). In a typical scenario, the firm is enveloped by an operating environment and doesn't look beyond it at the changes occurring in the general business environment that should be incorporated into their strategy. Each of the STEEP factors is further described in the following pages.

Social

Social factors relate to human society, interactions between individuals and groups, as well as the welfare of human beings as members of a society (Merriam-Webster, 2010). Andrews (1999) identified some of the common contributing factors as: the quest for equality in minority groups; the demand of women for opportunity and recognition; the changing patterns of work and leisure; the effects of urbanization upon the individual, family and neighborhood; the rise of crime; the decline of conventional morality; and the changing composition of world population. Drucker (1985) and Porter (1990) also stressed the importance of following changes in demographics or buyers needs in order to capitalize on opportunities for innovation.

Social factors can be very important in terms of recognizing new market opportunities and new sources of supply. Schul and Blanc (2008) provide evidence to the importance of cultural awareness, namely the ability to speak the same language and understanding cultural differences during business negotiations, as key drivers of procurement excellence because they can be crucial to obtaining procurement contracts. Social factors are also important in terms of identifying new products or services. By understanding the changes in consumer preferences and needs as a result of the changing welfare of society, firms can capitalize on opportunities to develop products or services that serve dynamic and/or emerging markets (Schul and Blanc, 2008). Additionally, social factors are important drivers of changing business models in order to tap into these emerging markets. Anderson and Markides (2007) argue that companies need to mobilize their resources differently to serve emerging markets by 1) assuming sufficient underserved or non-consumers exist if products are made affordable, 2) adapting the products to meet the needs of consumers who have fewer resources and different cultural backgrounds, and 3) establishing basic promotional materials, methods of production and distribution channels from the ground up. From an internal firm perspective, social factors may also be a barrier to innovation (Christensen et al., 1973).

Technological

Technology is considered the most rapidly changing of the environmental factors impacting firms (Christensen et al., 1973; Clark, 1987; Andrews, 1999). Technological factors include the discoveries of science, the impact of related product development, the incremental machinery and process improvements, and the progress of automation and data processing (Andrews, 1999). Changes in technology can include improvements to product design, marketing, production, delivery or the provision of associated activities (Porter, 1990).

Adapting the strategy of a firm to rapidly changing technology can create a competitive advantage in all areas of innovation. New sources of supply and new markets may not only be explored through advances in technology (such as social networking technology and the internet), but through advances in inventory management systems and enterprise resource planning systems that can help determine how that new source of supply or new market will fit with the firm's current inventories and types of suppliers. Schul and Blanc (2008) highlight the

importance of adapting to rapid changes in technology, especially those of product and service, as key drivers of excellence in procurement.

In much the same way, technology may also impact development of new products or services. Technologies that connect suppliers to customers provide an interface for the exchange of ideas, as well as problems. This exchange of information can provide firms the opportunity to develop new products or services that satisfy consumer needs.

New methods of production can be impacted by technology or a lack thereof. For example, much of the technology used in veneer production is not well advanced. New machines on the market have few significant improvements from prior models, which can impact the firm's source of competitive advantage in this area. Firms with more monetary resources may be able to create their own technology, while other firms must rely on adjustments or additions to the existing machinery to make improvements. Supply chain technologies, other information technologies, energy saving technologies, and water filtration technologies are just a few that could impact the methods of production of veneer industry firms.

A business model is the way in which a firm employs the resources available to it, whether natural resources, skills, or knowledge. Clark (1987) refers to "the significance of a change in technology for competitive advantage depends on its transilience—that is, its capacity to influence the firm's existing resources, skills and knowledge. Transilient technologies have the capacity to change a firm's business model.

Schul and Blanc (2008) and Porter (1990) note the importance of a tight coupling of business strategy with technological changes. Christensen, et. al. (1973) further deem slow recognition or adaptation to rapidly changing technological factors barriers to innovation when viewed from an internal firm perspective. And Porter (1990) noted that industries which embrace old technology may lack the necessary vision to recognize the importance of technological changes, and often have more difficulty in responding.

Ecological

Christensen, et. al. (1973) labels ecological factors 'physical' factors of the environment. Yet the definition does not change much as to what consists of an ecological factor of the environment:

physical characteristics of the environment favorable to industrial development, transportation, changing standards of environmental quality, and impacts to life in general wherever the production facility is located (Andrews, 1999). Porter (1990) also acknowledges the emergence of new industry segments as shifters of competitive advantage that cause innovations.

A firm typically chooses the location to build a plant for a number of factors of that specific location that may change after the plant has been built. For example, at the time when a plant was built, local, regional, state or even federal regulations may have allowed for unrestricted access to natural resources (i.e., logs) that overtime may change. Issues like forest certification or due diligence to ensure legality of imports may influence the firm's strategy for sourcing logs, or the logistics of procurement of a new source of supply. The firm may need to search for an entirely new product in the region to be competitive, in which case, the methods of production would need to be adjusted. Perhaps an entirely new business model may even be necessary if the impacts of this regulation are severe enough. Globalization has increased the scope of a firm's ecological environment to include operations in different countries with varying conditions around the globe (Schul and Blanc, 2008).

Economic

In 2008, firms around the globe were reminded of the importance of paying attention to their economic environment. The housing market crash in the US and the subsequent economic implications in Europe and around the globe drew attention to the interconnectedness of global markets. Andrews (1999) described some contributing factors of the economic environment as follows: trade developments of foreign countries, globalization of competition, changing structure of industries in developing countries, Americanization of demand in foreign countries, persistent inflation in all phases of the business cycle, and the recurrence of recession. Porter (1990) identifies significant changes in inputs (i.e., labor, material costs, transportation, energy, etc.) or availability as environmental factors that impact innovation.

Economic factors have impacted the globalized nature of trade in many ways. Lower currency rates have changed countries, like the United States that were once major importers of products, into primary exporters of products, disturbing the flow of cargo shipping across the oceans (Levitz et al., 2010). Ships from the US have been slow to reach customers around the globe

because shipping companies are afraid of the costs of sending full ships to countries and empty ships returning (Levitz et al., 2010). This been associated with a stunted economic recovery in the US because suppliers of goods usually receive payment upon arrival, and most goods end up sitting at ports for long periods of time (Levitz et al., 2010).

In other words, new markets have opened up due to the ability of customers in foreign countries to purchase goods from the US at a lower rate. For example, markets in Brazil, Russia, India and China, with seemingly insatiable demand, can impact the procurement arrangement by expanding the need to search for new sources of supply (Schul and Blanc, 2008). Lower costs of labor in some countries have shifted where products are produced (Porter, 1990). New ways of communicating and distributing goods to customers can accommodate a change in trade flows from domestic to export and lead to additional competitive advantages (Porter, 1990). Supply relationships may have changed so that suppliers may simultaneously be customers and some suppliers may be sourcing to major competitors (Schul and Blanc, 2008). These new relationships may cause innovations by inciting new ideas for products or services, causing a need for new sources of supply to feed production, creating innovative supply chain arrangements or even developing new business models that organize and manage the firms' operations.

Political

Political factors of the environment are among the slowest factors to change, but can have a dramatic impact on firms when they do. Some of the contributing factors to this phenomenon are: the changing relations between communist and non-communist countries as well as poor and prosperous countries, the relation between private enterprise and government, the relation between workers and management, and the impact of national planning on corporate planning (Andrews, 1999). Porter (1990) defines the political environment in this sense as changing government regulations.

Regulators from the European Union and United States are involved in policy-making that would enact more stringent requirements on supply chains, in particular the procurement function, to standardize emissions and 'green' energy efficiencies (Schul and Blanc, 2008). New sources of supply or new markets may be sought in order to comply with these new policies. Another

impact on supply chains may occur from international political efforts to curb sweatshops and child labor, which may be used even in the wood products industry in other parts of the world. In response to changing labor regulations, firms may be required to search for new sources of supply that don't employ child labor or run sweatshops. Often the reason for purchasing goods from such sources is because they are cheaper, so new markets may need to be found that will purchase higher priced goods. A new business model may even be necessary in order to accomplish these tasks.

In addition, during US President Barack Obama's State of the Union Address, he described a national plan to encourage business growth by providing a tax incentive to all large businesses and all small businesses to invest in new plants and equipment (whitehouse.gov, 2010). The impact of this political action could impact business innovation strategy by providing the impetus for businesses to act now as opposed to later in terms of investing in innovation.

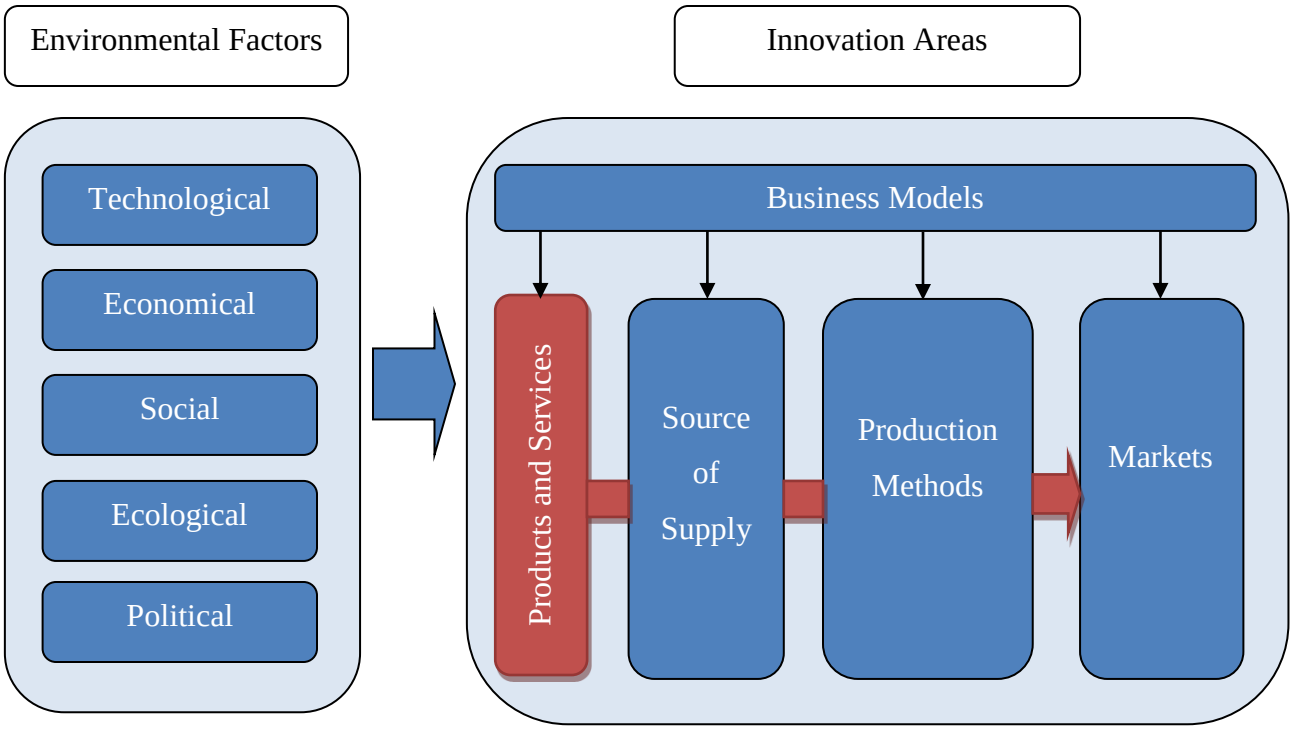


Figure 5. Hypothetical model of the environmental impacts to innovation

A hypothetical model of the environmental impacts to innovation strategies is shown in Figure 5. In this model the factors of innovation are pictured as they would be found in a firm, with the business model as the way the firm allocates resources to the supply chain (sources of supply,

methods of production and markets) and the products and services they offer. The products and services can be found in any or all steps of the supply chain, hence their prominent color and the arrow guiding them through the supply chain. Because it is not known how the environmental factors impact the five areas of innovation, these factors are depicted as separate from the innovation areas. The environmental factors are considered separate from one another and are listed in an order hypothetical of the amount each factor influences innovation, with technological factors hypothesized to impact innovation more than political factors. The purpose of this research is to further refine this model to help firms understand how to innovate in a given environment.

Objectives and Potential Outcomes of the Research

The primary aim of this research is improve the understanding of the impacts external environmental factors have on hardwood veneer industry firm strategies and to provide the industry with actionable recommendations to improve their innovativeness given different environmental pressures. A secondary objective of this research is to disseminate the findings at the end of the study to the industry individually, through benchmarking reports to industry firms participating in the research, as well as publicly, through publication of the research findings in trade journals. Specific objectives of this research are:

1) to identify strategies that hardwood veneer industry firms use to innovate,

2) to describe how environmental factors impact hardwood veneer firms' innovation strategies,

3) to compare the innovation strategies and prevailing environmental impacts for Austrian/German and American hardwood veneer firms, and

4) to develop recommendations for the hardwood veneer industry to improve their innovation strategies given existing environmental conditions.

Two main outcomes of this research are sought: 1) the increased awareness of the need to develop a strategy for firm innovation, and 2) the increased awareness of the need to examine the environmental conditions for potential opportunities or threats to firm innovation. Other potential outcomes of this research are: the addition of empirical evidence regarding both the impacts to innovation in business strategy literature and the application of the storytelling

method of data collection on the wood products industry in qualitative research methods literature, and the improvement of the Austrian and US hardwood veneer industry firms' positions in the global marketplace as a result of increased knowledge of factors impacting industrial innovation and strategy improvements. Additionally, this research can be replicated to other forest industry sectors to improve innovation strategies of the entire forest products industry.

References

Abernathy, W.J. and K.B. Clark. (1985). Innovation: Mapping the winds of creative destruction. *Research Policy* 14(1): 3-22.

Afuah, A. (2004). Business Models: A Strategic Management Approach. New York, NY, McGraw-Hill Irwin.

Afuah, A. (2009). Strategic Innovation: New Game Strategies for Competitive Advantage. New York, NY, Routledge.

Alon, A. and D.D. Chow. (2008). How to get the most from your best ideas. Outlook. Accenture. Retrieved January 2, 2010 from: http://www.accenture.com/Global/Research_and_Insights/Outlook/default.htm.

Anderson, J. and C. Markides. (2007). Strategic innovation at the base of the pyramid. *MIT Sloan Management Review* 49(1): 83-88.

Andrews, K.R. (1999). The concept of corporate strategy. In: The Strategy Process : Concepts, Contexts, Cases. Mintzberg, H., J. B. Quinn and S. Ghoshal. London, UK, Prentice Hall. 51-60.

Anonymous (1993). Trade in tropical timber: For the chop. The Economist. London, UK, Economist Newspaper Group, Inc. 326: 1.

Anonymous. (2009). Personal communication. August 13, 2009.

Barnes, D. (2001). Research methods for the empirical investigation of the process of formation of operations strategy. *International Journal of Operations and Production Management* 21(8): 1076-1095.

Bethel, J.S. and C.A. Hart. (1960). Techniques for the development of a rational grading system for hardwood veneer logs. *Forest Products Journal* 10(6): 296-301.

Blackman, T. (1993). Veneer firm doubles output of high-quality hardwoods. *Wood Technology* 120(6): 19-20.

Boehlke Veneer Corp. (2010). Cover My World. Retrieved May 27, 2010, from http://www.mbveneer.com/index.html.

Boer, H. and W.E. During. (2001). Innovation, what innovation? A comparison between product, process and organizational innovation. *International Journal of Technology Management* 22(1,2,3): 83.

Bowersox, D.J., D.J. Closs and M.B. Cooper. (2002a). 21st century supply chain. In: Supply Chain Logistics Management. McGraw-Hill.

Bundesamt für Wald. (2002). Wirtschaftswald holzarten. Bundesamt für Wald, Österreichische Waldinventur 2000/02. Retrieved January 17, 2010, from http://web.bfw.ac.at/i7/Oewi.oewi0002?geo=0&isopen=3&display_page=19.

BWI^2. (2004). 2.01.3: Waldfläche (ha) nach Land und Eigentumsart. Bundeswaldinventure^2. Retrieved March 14, 2011, from: http://www.bundeswaldinventur.de/

Callahan, J.C. (1990). The Fine Hardwood Veneer Industry in the United States: 1838-1990. Lake Ann, MI, National Woodlands Publishing Company.

Cao, X. and E.N. Hansen. (2006). Innovation in China's furniture industry. *Forest Products Journal* 56(11/12): 33-43.

Cassens, D.L. (1992). Factors Affecting the Quality of Timber for Face Veneer. West Lafayette, IN, Purdue University Cooperative Extension.

Cassens, D.L. (2004a). Factors Affecting the Quality of Hardwood Timber and Logs for Face Veneer. West Lafayette, IN, Purdue University Cooperative Extension.

Cassens, D.L. (2004b). Manufacturing Fine Hardwood Face Veneers. West Lafayette, IN, Purdue University Cooperative Extension.

CEI-bois. (2011). About the industry. CEI-bois. Retrieved March 14, 2011, from: http://www.cei-bois.org/en/about-the-industry.

CEN. (1994). Klassifizierung nach dem Aussehen der Oberflaeche, Teil 1: Allgemeines. Brussels, CEN Zentralsekretariat.

CEN. (1995). Klassifizierung nach dem Aussehen der Oberflaeche, Teil 2: Laubholz. Brussels, CEN Zentralsekretariat.

Christensen, C.R., K.R. Andrews, and J.L. Bower. (1973). The company and its environment: Relating opportunities and resources. In: Business Policy : Text and Cases. Homewood, Ill., R. D. Irwin. xvii, 846 p.

Clark, K. (1987). Investment in new technology and competitive advantage. In: The Competitive Challenge: Strategies for Industrial Innovation and Renewal. D. J. Teece. Cambridge, Mass., Ballinger Pub. Co.: 59-81.

Cooper, R.G. (1985). Overall corporate strategies for new product programs. *Industrial Marketing Mangement* 14(3): 179-193.

Crespell, P. and E.N Hansen. (2008). Managing for innovation: Insights into a successful company. *Forest Products Journal* 58(9): 6-18.

Cropp, J. (1966). Moderne Furnier-messermachine. *Holz als Roh- und Werkstoff* 24(4): 454-457.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal* 34(3): 555-590.

Danzer. (2002). Focus on veneer quality: Production starts at the new veneer mill in Prague with slicers developed by Danzer itself. Press release. Danzer Group. Retrieved May 27, 2010 from.

Deschamps, J.P. (2008). Innovation Leaders : How Senior Executives Stimulate, Steer and Sustain Innovation. Chichester, England ; Hoboken, NJ, Jossey-Bass.

Dimas, S. (2008). Commission Regulation (EC) No 1024/2008. 1024/2008. T. C. o. t. E. Communities. Brussels, Official Journal of the European Union.

DIN. (1976a). Fachnormenausschuss Holz: Furnier, Dicken. Deutsche Institute fuer Normung.

DIN. (1976b). Normenausschuss Holz: Furnier, Begriffe. Deutsche Institute fuer Normung.

Dodgson, M. and R. Rothwell. (1994). Handbook of Industrial Innovation. Hants, UK, Edward Elgar.

Drucker, P.F. (1985). The discipline of innovation. *Harvard Business Review* 63(3): 67-72.

EEA. (2007). European forest types. Copenhagen, Denmark, European Environment Agency.

Ellig, J. (2001). Dynamic Competition and Public Policy : Technology, Innovation, and Antitrust Issues. Cambridge ; New York, Cambridge University Press.

Fachverband. (2009). Die Oesterreichische Holzindustrie Branchenbericht: 2008/2009. Wien, Oesterreich, Fachverband der Holzindustrie Oesterreichs.

FAOSTAT. (2009). ResourceSTAT land resource statistics. Food and Agriculture Organization of the United Nations, Statistics Division. Accessed January 15, 2010 at: http://faostat.fao.org/site/377/default.aspx#ancor.

FAOSTAT. (2010). ForesSTAT trade statistics. Food and Agriculture Organization of the United Nations, Statistics Division. Accessed January 15, 2010 at: http://faostat.fao.org/site/626/default.aspx#ancor.

FAOSTAT. 2011. ForesSTAT trade statistics. Food and Agriculture Organization of the United Nations, Statistics Division. Accessed January 27, 2011 at: http://faostat.fao.org/site/626/default.aspx#ancor

FAS. (2005). GAIN Report: Austria's wood products sector continues growth. Foreign Agricultural Service. Retrieved January 14, 2010, from http://www.fas.usda.gov/gainfiles/.

FAS. (2006). GAIN Report: Germany Solid Wood Products Annual. Foreign Agricultural Service. Retrieved March 14, 2010, from: http://www.fas.usda.gov/gainfiles/.

FAS. (2009). Wood products. Foreign Agricultural Service. Retrieved December 20, 2009, from http://www.fas.usda.gov/ffpd/forest.asp.

Fleisher, C.S. and A. Bensoussan. (2002). Strategic and Competitive Analysis: Methods and Techniques for Analyzing Business Competition. Upper Saddle River, NJ, Prentice Hall.

Flikkema, M. P. Jansen, and L. Van der Sluis. (2007). Identifying neo-Schumpterian innovation in service firms: A conceptual essay with a novel classification. *Economics of Innovation & New Technology* 16(7): 541-558.

Forth, K.D. (2008). Multiple trends for cabinets. *FDM* 80(3): 44-45.

Freeman, G. (2009). Hardwood Plywood and Veneer Association Chairman. Personal communication. November 6, 2009.

Fuchs, F.R. (1981). Moderne Messerfurnierherstellung. *Holz als Roh- und Werkstoff* 39(5): 179-192.

Furnierwerk. (2006). Veneers: A Fritz Kohl Handbook. Karlstadt, Germany, Furnierwerk Fritz Kohl GmbH & Co. KG.

Galbraith, J.K. (1967). The New Industrial State. Boston, MA, Houghton-Mifflin.

German Timber. (2007). Forest and wood industries in Germany at a glance. The German Timber Promotion Fund. Retrieved March 14, 2011, from: http://ecotec-energiesparhaus.de/Daten/Holztechnik-Forest-and-wood-industries-in%20Germany%20at-a-glance.pdf

Giesen, E., S.J. Berman, R. Bell, and A. Blitz. (2007). Paths to success: Three ways to innovate your business model. IBM Global Business Services. Retrieved June 20, 2009 from: http://www-935.ibm.com/services/us/index.wss/ibvstudy/gbs/a1028552?cntxt=a1005266.

Håkansson, H. (1987). Industrial Technological Development : A Network Approach. London ; Dover, N.H., Croom Helm.

Hamel, G. (2006). The why, what, and how of management innovation. *Harvard Business Review* 84(2): 72-84.

Hansen, A.H. (1951). Schumpeter's contribution to business cycle theory. *Review of Economic Statistics* 33: 129-132.

Harrar, E.S. (1954). Defects in Hardwood Veneer Logs: Their Frequency and Importance. SE-30. Asheville, NC, USDA Forest Service, Southeastern Forest Experiment Station.

Harrar, E.S. and R.A. Campbell. (1966). The Major Defects in Southern Hardwood Veneer Logs and Bolts. SE-19. Asheville, NC, USDA Forest Service, Southeastern Forest Experiment Station.

Henley, J.W., R.O. Woodfin, and H.H. Haskell. (1963). Recommended Veneer Grades for the Development of Hardwood Veneer Log Grades. FPL-9. Madison, WI, USDA Forest Service, Forest Products Laboratory.

Herman, E.A. (1970). Veneer grade line apparatus. United States. Herman, Emil A. Patent No. 3545744. Retrieved December 18, 2009 from: http://www.freepatentsonline.com/3545744.html.

HVN. (2011). Mehr Jobs als der Automobile Industrie. Holz verantwortungsvoll Nutzen. Retrieved March 14, 2011, from: http://www.holz-verantwortungsvoll-nutzen.de/?p=307

Hoover, W.T. (2008). 2008 Indiana Forest Products Price Report and Trend Analysis. FNR-177-W. West Lafayette, IN, Purdue University Cooperative Extension.

Hoover, W.T. and R.W. Gann. (1999). Indiana Forest Products Price Report and Trend Analysis. West Lafayette, IN, Purdue University Cooperative Extension.

Hovgaard, A. and E.N. Hansen. (2004). Innovativeness in the forest products industry. *Forest Products Journal* 51(4): 26.

HPVA. (2009). Online Membership Directory. Retrieved December 18, 2009, from http://www.hpva.org/search.asp.

Hunt, S.D. (2007). Economic growth: Should policy focus on investment or dynamic competition? *European Business Review* 19(4): 274-291.

IBM Global Business Services. (2006). Expanding the innovation horizon: The global CEO survey 2006. Retrieved December 20, 2009, from http://www.ibm.com/bcs/ceostudy.

ITTO. (2009a). Tropical Timber Market Report. 14(23). Retrieved online, from http://www.itto.int/en/market_information_service/.

ITTO. (2009b). Tropical Timber Market Report. 14(17). Retrieved online, from http://www.itto.int/en/market_information_service/.

IUFRO. (1973). Veneer Species of the World. Madison, WI, IUFRO Working Party on Slicing and Veneer Cutting, USDA Forest Service, Forest Products Laboratory.

IWPA. (2000). Product standard for imported wood veneer and platforms. IHPA-2000. Retrieved December 18, 2009, from http://www.veneernet.com/veneerstandard.pdf.

Juslin, H. and E. Hansen. (2002). Strategic Marketing in the Global Forest Industries. [Corvallis, Or.], Authors Academic Press.

Kambil, A. (2002). Good ideas are not enough: Adding executive muscle to innovation engines. Accenture. Retrieved January 2, 2010 from: http://www.accenture.com...good_ideas_are_not_enough.pdf.

Kaplinsky, R. and J. Readman. (2005). Globalization and upgrading: What can (and cannot) be learnt from international trade statistics in the wood furniture sector? *Industrial and Corporate Change* 14(4): 679-703.

Keklik, M. (2003). Schumpeter, Innovation and Growth: Long-cycle Dynamics in the Post-WWII American Manufacturing Industries. Burlington, VT, Ashgate Publishing Company.

Keylwerth, R. (1965). Furnier als Bodenbelag. *Holz als Roh- und Werkstoff* 23(11).

Levitz, J., T. Audi, and J.W. Miller. (2010). Export revival threatened by shipping bottlenecks. The Wall Street Journal. New York, NY, Dow Jones & Company, Inc.

Lincoln, W.A. (1984). The Complete Manual of Wood Veneering. New York, NY, Charles Scribner's Sons.

Lundvall, B. (1985). Innovation as an inter-active process: From user-producer interaction to the national system of innovation. In: Technical Change and Economic Theory. G. Dosi, C. Freeman, R. Nelson, G. Silverburg and L. Soete. London, UK, Pinter Publishers. 349-369.

Luppold, W.G. (1994). The U.S. hardwood log export situation: What is the problem? *Forest Products Journal* 44(9): 63-68.

Lutz, J. (1977). Wood Veneer: Log Selection, Cutting, and Drying. 1577. USDA Forest Service.

Madlener, R. (2007). Innovation diffusion, public policy and local initiative: The case of wood-fuelled district heating systems in Austria. *Energy Policy* 35: 1992-2008.

Marunaka. (2005a). History of company. Retrieved January 18, 2010, from http://www.marunaka-jp.com/new.eng/new.history.htm.

Marunaka. (2005b). Thick veneer slicer, Thin veneer slicer. Retrieved January 18, 2010, from http://www.marunaka-jp.com/new.eng/tothin.htm.

Merriam-Webster. (2010). Social. Merriam-Webster Online Dictionary. Retrieved March 14, 2010, from http://www.merriam-webster.com/dictionary/social.

Millson, M.R., S.P. Raj, and D. Wilemon. (1996). Strategic partnering for developing new products. *Research Technology Management* 39(3): 41-50.

Mintzberg, H. (1978). Patterns in strategy formation. *Management Science* 24(9): 934-948.

Mintzberg, H. and J.A. Waters. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal* 6: 257-272.

Mondal, W.I. and J. Espana. (2006). Patent rights, mergers and entrepreneurship in the biotechnology industry of Sweden. *Journal of American Academy of Business* 8(1): 172-175.

OECD. (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. Organization for Economic Co-operation and Development, Eurostat, European Commission.

Oesterreichische Lebensministerium. (2008). To whom do Austria's forests belong? Retrieved online, from http://forst.lebensministerium.at/article/articleview/63306/1/14174/.

Ohm, L. (2005). A decade of kitchen trends. *FDM* 77(9): 40-42.

Olah, D., R. Smith, and B. Hansen. (2003). Wood material use in the US cabinet industry 1999 to 2001. *Forest Products Journal* 53(1): 25-32.

Oliver, R. (2009). EU proposed illegal wood law has profound implications for the whole wood trade. Press release. A. H. E. Council. Europe.

Petutschnigg, A. (2008). Furnier neu interpretieren. Retrieved May 28, 2010, from http://www.fhs-forschung.at/fileadmin/documents/holz/Projekte/Laufende/Danzer_korrig.pdf.

Porter, M.E. (1985). Competitive Advantage : Creating and Sustaining Superior Performance. New York, NY: The Free Press.

Porter, M.E. (1990). The Competitive Advantage of Nations. New York, NY: The Free Press.

Porter, M.E. (1998). Competitive Strategy: Techniques for Analyzing Industries and Competitors. New York, NY: The Free Press.

proHolz. (2010). Unternehmen Holz. Retrieved May 27, 2010, from http://www.proholz.at/wald_holz/unternehmen_holz.htm.

Quesada-Pineda, H. (2010). Innovation activities in the primary wood products sector: A case study. *Wood and Fiber Science*. 42(4): 511-522.

Quinn, J.B. (1999). Strategies for change. In: The Strategy Process : Concepts, Contexts, Cases. H. Mintzberg, J. B. Quinn and S. Ghoshal. London, UK, Prentice Hall. 5-13.

researchandmarkets.com. (2009). Hardwood veneer and plywood manufacturing industry in the US and its international trade. Retrieved January 2, 2010, from http://www.researchandmarkets.com/reportinfo.asp?report_id=461729&t=e&cat_id=.

Robertson, T.S. and H. Gatignon. (1998). Technology development mode: A transaction cost conceptualization. *Strategic Management Journal* 19(6): 515-531.

Rogers, E.M. (1962). Diffusion of Innovations. New York, Free Press of Glencoe.

Rogers, E.M. (1995). Diffusion of Innovations. New York, Free Press.

Rother, M. and Shook, J. (1999). Learning to See. Brookline, MA, The Lean Enterprise Institute, Inc.

Roy, S., K. Sivakumar, and I.F. Wilkinson. (2004). Innovation generation in supply chain relationships: A conceptual model and research propositions. *Journal of the Academy of Marketing Science* 32(1): 61-79.

Sauber, T. and H. Tschirky. (2006). Structured Creativity : Formulating an Innovation Strategy. Basingstoke [England] ; New York, Palgrave Macmillan in association with the European Institute for Technology and Innovation Management.

Sawhney, M., R.C. Wolcott, and I. Arroniz. (2006). 12 Different ways for companies to innovate. *MIT Sloan Management Review* 47(3).

Schramm, A. (2003). A Complete Guide to Hardwood Plywood and Face Veneer. West Lafayette, IN, Purdue University Press.

Schul, H. and D. Blanc. (2008). The drivers of procurement excellence. *Supply Chain Management Review* 12(8): 30.

Schumpeter, J.A. (1939). Business Cycles : A Theoretical, Historical, and Statistical Analysis of the Capitalist Process. New York ; London, McGraw-Hill Book Company, Inc.

Schumpeter, J.A. (1942). Capitalism, Socialism and Democracy. New York, NY, Harper and Row.

Schumpeter, J.A. and R. Opie. (1968). The Theory of Economic Development; An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Cambridge, Mass., Harvard University Press.

Showalter, J., R. Glowinski, G. Woodson, and E.W. Price. (2003). Framing the future: Breakthrough technology for wood and wood composites. *Forest Products Journal* 53(3): 4-10.

Sivadas, E. and F.R. Dwyer. (2000). An examination of orgainzational factors influencing new product success in internal and alliance-based processes. *Journal of Marketing* 64(1): 31-50.

Smith, W.B., P.D. Miles, C.H. Perry, and S.H. Pugh. (2009). Forest Resources of the United States, 2007. WO-78. Washington, D.C., USDA Forest Service, Washington Office.

Snyder, N.T. and D.L. Duarte. (2003). Strategic Innovation : Embedding Innovation as a Core Competency in your Organization. San Francisco, Jossey-Bass.

Sundbo, J. (1998). The Theory of Innovation : Enterpreneurs, Technology and Strategy. Cheltenham, UK ; Northampton, MA, USA, E. Elgar.

US Census Bureau. (2009). 2007 Economic Census. Retrieved January 2, 2010, from http://www.census.gov/econ/census07/.

veneernet.com. (2009). Grading veneer. Retrieved December 18, 2009, from http://www.veneernet.com/grading.htm.

Wagenfuehr, A., B. Buchelt, and A. Pfriem. (2006). Material behavior of veneer during multi-dimensional moulding. *Holz als Roh- und Werkstoff* 64(2): 83-89.

Wagner, E. and E.N. Hansen. (2005). Innovation in large versus small companies: Insights from the US wood products industry. *Management Decision* 43(5/6): 837-851.

West, M.A. and J.L. Farr. (1990). Innovation and Creativity at Work : Psychological and Organizational Strategies. Chichester, England ; New York, Wiley.

whitehouse.gov. (2010). Remarks by the President in the State of the Union Address. Retrieved March 14, 2010, from http://www.whitehouse.gov/the-press-office/remarks-president-state-union-address.

Wiedenbeck, J.K., M. Wiemann, D. Alderman, J. Baumgras, and W.G. Luppold. (2004). Defining Hardwood Log Quality Attributes. NE-313. Newtown Square, PA, USDA Forest Service, Northeastern Research Station.

Windrum, P. and M. Garcia-Goni. (2008). A neo-Schumpterian model of health services innovation. *Research Policy* 37(2008): 649-672.

Zahn, E. (1986). Innovations- und Technologiemanagement: Eine strategische Schluesselaufgabe der Unternehmen. In: Technologie- und Innovationsmanagement. E. Zahn. Berlin, Germany, Duncker & Humblot.

Zaltman, G., R. Duncan, and J. Holbek. (1973). Innovations and Organizations. New York, NY, Wiley.

Chapter 2: Methods

Overview of Research Methodologies

To explain the impacts the environmental factors have on innovation strategies of hardwood veneer industry firms, it is necessary to use a method that allows for the causal linkages of contemporary events that impact industry firms to be analyzed within a real-life context. Yin (2009) describes the value of the case study method for this type of analysis of 'how' or 'why' research questions. The case study method is particularly useful for explaining causal linkages because it allows many types of evidence (i.e., interviews, documentation, direct observations, physical artifacts, archival records, and participant observation) to support, through triangulation, the research propositions at hand (Yin, 2009). A researcher of a history, for example, would not have direct observations and interviews at their disposal because the event would not be contemporary enough to have living witnesses (Yin, 2009).

Research design is critical for using case studies as a research method. Important components of a research design include: 1) 'how' or 'why' questions that would provide new insights to the area of study; 2) research propositions that create a purpose or focus for the study; 3) identification of the unit of analysis under investigation, including spatial, temporal or other boundaries of the defined unit; 4) possible methods for linking data to the research propositions that will aid collecting sufficient data; and 5) criteria for interpreting the study's findings, such as addressing rival explanations (Yin, 2009). In addition, Yin (2009) argues that a quality case study should exhibit soundness in the operations used to measure the concepts under study (i.e., construct validity), have causal linkages that are established via conditionality (i.e., internal validity), have findings that can be generalized to a broader population (i.e., external validity), and have repeatable operations of the study (i.e., reliability) occurring within the appropriate phase of the research process. Finally, quality case studies should be designed initially as single or multiple cases with embedded (multiple) or holistic (single) units of analysis (Yin, 2009).

In an industry like the hardwood veneer industry, with firms exhibiting different types, a multiple case study approach that allows theoretical sampling from each of the firm type groups is preferred. Eisenhardt (1989) and Harrigan (1983) suggest an approach to building theories from case studies in which theoretical sampling of case studies is conducted. Other attributes of this

approach are highly relevant for use in a study on impacts to innovation strategies in the hardwood veneer industry. For example, the approach encourages neither theory nor hypotheses to be established before the case study begins in order to maintain theoretical flexibility. This is particularly useful for allowing research participants to determine the specific environmental factors that are relevant for investigation. Creation of hypotheses occurs after these factors have been identified, and data collection and data analysis occur simultaneously. The iterative nature of the approach to case study research allows the hypotheses to be created at an appropriate time during the study and then tested.

Eisenhardt (1989) created the following stepwise process of building theory from case study research:

Getting Started

Define research question and some a priori constructs in order to focus the efforts of the study and to provide better grounding of the construct measures.

Selecting Cases

Specify a population that will constrain extraneous variation and to sharpen external validity. Theoretical sampling should be undertaken as opposed to random sampling to focus efforts on theoretically useful cases or cases that extend the theory by filling conceptual categories.

Crafting Instruments and Protocols

Use of multiple data collection methods is recommended to strengthen grounding of the theory by triangulation of evidence. The data collection should include both quantitative as well as qualitative data to obtain a synergistic view of the evidence.

Entering the Field

Overlap data collection and data analysis to speed analyses and reveal helpful adjustments to data collection. Using flexible and opportunistic data collection methods allows investigators to take advantage of emergent themes and unique case features.

Analyzing Data

Eisenhardt (1989) recommends using within-case analysis to gain familiarity with data and preliminary theory generation, and cross-case pattern searches using divergent techniques to focus beyond the initial impressions and see evidence through multiple lenses.

Shaping Hypotheses

Tabulate evidence iteratively for each construct to sharpen the construct definition, validity and measurability. Replication logic, as opposed to replication sampling, should be used across cases to confirm, extend and sharpen the theory being generated. And the evidence should be searched for 'why' behind the relationships under investigation in order to build internal validity.

Enfolding Literature

Further exploration of the literature is important to make a comparison with conflicting literature that will build internal validity. Comparisons should also be made with similar literature to sharpen generalizability. Making these comparisons also increases the theoretical level of the study and sharpens construct definitions.

Reaching Closure

Finally, if theoretical saturation is possible, the process will end when marginal improvement becomes small (i.e., diminishing returns).

The theory building framework endorsed by Eisenhardt (1989) suggests the strength of using multiple methods of data collection, as does the approach to studying business strategies described by Harrigan (1983). Of the types of evidence identified by Yin (2009) that can be collected for a case study, only participant observation will not be applied in this research. Documentation (i.e., e-mail, brochures and webpages) is particularly useful for identifying whether or not innovation is a focus of a firm's strategies, as well as triangulating that information with the information gained from environmental experts. Archival records (i.e., public use records, census information, company budgets and personnel records, and geographic data) can also be useful for identifying firms to include in the sample, gathering information on the company environment, and identifying impacts to innovation strategies. Physical artifacts

(i.e., new products, veneer samples, and technological tools) can be helpful in identifying and understanding innovations of the firm and what external factors may impact them. Direct observation during plant or office tours and interviews can gain helpful insight into the causal linkages between innovation strategies and environmental impacts as well.

Narrative interviewing is also an integral part of case study data collection. Interviewers should be knowledgeable of the subject area in order to pose questions that will obtain the desired response. Various forms of interviews exist, from survey interviews to in-depth interviews, but Czarniawska-Joerges (2007) summarized the usefulness of a narrative interviewing technique called storytelling in organizational research. Experts have supported the use of storytelling as a form of narrative inquiry in organizations due to the natural tendency humans have to frame responses in the form of a story (Boje, 1991; Czarniawska-Joerges, 2007; Webster and Mertova, 2007). Not only do events play out temporally within a story, but the storyteller shares a plot that conveys a meaning or judgment within the story, both of which can be important for establishing causality.

Qualitative methods, such as case studies, provide the researcher with a framework for investigating complex issues of significance to research participants with more ease than quantitative methods (Webster and Mertova, 2007). However, Yin (2009) and Eisenhardt (1989) also identify a case study framework or strategy for analyzing evidence gathered during case study data collection that combines qualitative with quantitative data. For example, quantitative data may be a useful tool for describing an interaction between an embedded unit of analysis (i.e., company within an industry) and its environment (Yin, 2009). Eisenhardt (1989) argues that when coupled, quantitative and qualitative methods can provide synergy in viewing the evidence.

One valuable tool for collecting quantitative data is survey research. A survey is a systematic collection of data from a standardized set of questions that aim to measure an aspect or certain aspects of a sample or population (Sapsford, 1999). A census is a survey administered to an entire population, instead of a sample from the population. Due to the small numbers of hardwood veneer industry firms in the US, Austria and Germany, a census survey was attempted in this research. In addition, due to the geographic limitations of working with firms on two

continents, an online survey was used to ease the data collection process and decrease the response time for respondents abroad.

Some of the main considerations to address when using surveys in research are 1) ways in which error will be accounted for, 2) establishing procedures involved in contacting and communicating with respondents, and 3) establishing rapport with survey respondents that aids receiving quality responses. Dillman, et al. (2009) provides a method for incorporating all three of these concerns into effective survey research called the tailored design method. In this method, researchers are provided with essential tasks involved in survey research as well as potential modes of completing the tasks to tailor a survey for effectiveness. Potential sources of error in survey research discussed include: coverage error (adequate inclusion of representative members of the population), sampling error (sufficient sample size drawn from the population), nonresponse error (implementation system that encourages most sample members to respond), and measurement error (inadequate responses to survey questions), (Dillman et al., 2009).

Data analysis of qualitative data is often a complicated task due to the sheer amounts of data that may accumulate during the data collection process. Literature on the subject all suggests first finding a focus or building a conceptual framework to guide the data analysis. A stepwise approach to qualitative data analysis proposed by Dey (1993) begins by answering questions, such as: what type of data has been collected, how can the data be characterized, what were the initial research objectives, are there any exceptions or alternative representations of the data, and who is the audience. The next step involves using personal experience, general culture and academic literature to find a focus for the qualitative data analysis.

Dey (1993) then recommends creating categories from the data by making an affinity diagram, for example. To do this, consideration needs to be taken as to what data have been collected and what are the future results of the analysis. The categories may be inclusive or exclusive, connected or disconnected and broad or specific. During this step, all data must be categorized, considered in context, and must not be duplicated to fit into categories (or have data in multiple categories). After the initial categories have been made, further refinement of the categories may be necessary.

Once the categories have been created, Dey (1993) proposed that data can be pattern matched with the categories through either a sequential or selective process. A more detailed analysis can be achieved by splitting data from categories into subcategories, or a more integrated analysis can be achieved by splicing together data from categories to create new categories. The data from each case can then be analyzed within cases and across cases by linking categories, and associations can be used to analyze relationships in the data. Finally, data relationships can be further strengthened by identifying data that do not interact.

It is during this data analysis that Eisenhardt, (1989) recommends hypotheses be created and answers to 'why' searched for within the data. Hypothesis creation involves fully understanding the problem at hand and making 'risky predictions' that can be tested and can explain why the predicted event is expected (Gordon, 2007). Data analysis and data collection in case study research occur simultaneously, allowing additional data to be collected to fully understand the problem and hypotheses to be refined and tested. In order to test hypotheses, it is necessary to examine the ways in which the hypotheses can be proven false and use an approach that attempts to do just that (Gordon, 2007). Survey research and narrative interviewing are powerful tools to test hypotheses. Additionally, literature should be reviewed for supporting or opposing theories that explain or counter the phenomena represented in the data (Eisenhardt, 1989; Yin, 2009).

Dey (1993) describes mapping or representing the analyses in some fashion to aid explanation of it, while Gordon (2007) recommends modeling. One method for mapping the data is a SWOT analysis. The STEEP factors are commonly used in environmental models of competitive advantage to identify the opportunities and risks present in a firm's external business environment. In a SWOT analysis (Andrews, 1971), these external factors are compared to internal strengths and weaknesses of the firm from the resource-based model[2] of the firm. The internal strengths and weaknesses, and external opportunities and threats are typically included in a 2x2 table of lists. Understanding the opportunities and threats to the firm can greatly aid the recommendation generation process. Models, or structured abstractions, may also be created to

[2] The resource-based view of the firm considers the raw material, human, capital and other resources as elements of firm strategy that can be deployed to take advantage of market opportunities or mitigate threats. Therefore, the presence of certain resources are strengths, while the absence of certain resources are weaknesses (Hamel and Prahalad, 1994).

aid in understanding some of the elements of the research problem, hypothesis or theory (Gordon, 2007).

Finally, when efforts produce marginal returns in generating insights from the data, closure of the data analysis effort may occur (Eisenhardt, 1989), and reporting of the conclusions may begin.

Methodology for Innovation Strategy Identification

In this research, the question of how external firm factors impact innovation in the hardwood veneer industry was explored through case study analysis. The population under investigation was the hardwood veneer industry, with individual veneer firms serving as the unit of analysis. A multiple case study approach was used to gather perspectives from various, theoretically separated firms within the industry to provide a picture of the whole industry situation. Seven categories of firm type were identified from literature review and conversations with industry representatives: 1) small, single facility veneer producers, 2) product differentiators (i.e., single facility firms that produce veneer as well as one or more other products), 3) custom slicing companies (i.e., single facility companies whose business relies primarily or solely on slicing veneer for other companies), 4) veneer departments of large corporations (i.e., corporations who have vertically integrated to include veneer production as opposed to outsourcing this function), 5) multi-facility veneer producers located in a single country, 6) large, multinational veneer producers, and (7) veneer traders. The seventh category (i.e., veneer traders) exists but representatives from those firms were not interviewed. A stratified, theoretical sampling was conducted, where one firm from each of the six theoretical categories of veneer firm type was randomly selected in both Austria and the US for individual case study analysis.

The first step toward understanding how external firm factors impact innovation strategies in the hardwood veneer industry is to identify the innovation strategies hardwood veneer industry firms are using. Rumelt (1987) determined that every strategy is both unique and is concerned with the goals and objectives of the firm. The innovation strategies of hardwood veneer industry firms were ascertained through both document analyses (i.e., websites and company brochures) and recorded narrative interviews with top management of veneer industry firms and associations. An interview script and questions can be found in Appendix C (in English) and Appendix D (in German). Some of the questions that were answered during this stage are as

follows: Is it a goal of the firm to innovate? Did the firm innovate by circumstances other than their own intentions? Does the firm's innovation strategy tend to focus on certain types of innovations? If so, which ones? Did the firm intend to focus on these certain types of innovation? What are some of the actions the firm takes to implement their innovation strategy?

One goal of the narrative interviews was to obtain a story from each of the individuals interviewed that describes an innovation in each of Schumpeter's five areas of innovation. Analysis of these stories served as the beginning of innovation strategy identification. Interviews were transcribed and analysis of interview transcripts was aided by use of Microsoft Excel. Descriptions of each interview transcript were written in order to reduce the amount of data to analyze. These descriptions included codes of important constructs reflected in the questions. For example, the story was coded as either 'deliberate' or 'emergent' as one indicator of the firms' strategy for innovation.

Simultaneously with narrative interviews of veneer industry firms, Eisenhardt (1989) suggests that the data (i.e., documents, interview transcripts, direct observations, physical artifacts and archival records) related to the firm be analyzed. Miles and Huberman (1994) suggest that three levels of linking qualitative data to quantitative data can occur, namely the 'quantizing' level (i.e., qualitative data is directly counted), distinct data types (i.e., qualitative data is directly compared to quantitative data) and overall study design (i.e., multi-method approaches that incorporate both qualitative and quantitative methods). While the whole study is designed to incorporate both quantitative and qualitative methods, the quantizing level best describes the approach that can be applied here (Miles and Hubermann, 1994). This approach iterates qualitative and quantitative data collection and analysis throughout the study (Miles and Huberman, 1994). Qualitative data was analyzed with an emphasis on each of the five areas of innovation, to quantify in a binary fashion whether or not firms are innovating in each area and by counting multiple accounts from an interviewee of innovation in a particular area. Multiple accounts can build support for a specific type of innovation strategy within a firm (i.e., strong product innovator).

Then, qualitative data were analyzed for activities that might identify the innovation strategies pursued and actually in use in the firm. The innovation strategies were identified on the two continuums of customer/market and resource/capability. The firms that pursued a certain

innovation strategy made it a goal to be innovative in one extreme of both of these continuums. For example, one firm was identified as pursuing a resource-building innovation strategy. This means that it was a goal of the firm and/or the firm deliberately tried to innovate in the areas of sources of supply and production methods. The firm could have more emergent strategies in markets and products/services because the resource-building strategy uses existing markets and customers to exploit the new resources and capabilities created by firm. If the firm actually used a strategy, it means that it wasn't just a goal to innovate in the areas necessary; the firm had actually innovated in those areas.

The data analysis during this stage helped to generate propositions. For example, data analysis showed that two certain types of Austrian veneer firms had strong innovation tendencies, and it was then hypothesized that these same types of American veneer firms would also have strong innovation tendencies. The firms that are strong innovators also tend to have similar scope and scale, just as the firms with weaker tendencies to innovate are similar in scope and scale. Additional hypotheses were generated during this step and include between country differences in innovation type prevalence and between firm structure differences in innovation type prevalence. The hypotheses generated during this step as well as the results of the interview analysis are reported in Chapter 3. A subsequent part of this study tested these hypotheses via census survey to Austrian and German veneer industry firms, as well as through narrative interviews and census survey of veneer industry firms located in the United States. The remainder of this section briefly describes this work.

Following this initial data analysis and hypotheses creation, the internet-based census of American, Austrian and German hardwood veneer industry firms was conducted using the tailored design method (Dillman et al., 2009). Due to the international scope of the project, correspondence was primarily conducted via e-mail and telephone. The potential survey respondents each received an e-mail one week prior to conducting the survey notifying them of the nature and scope of the project. On the second week, a survey invitation was sent to the potential respondents with a link to the online questionnaire. A unique 5-digit access code was assigned to each company representative contacted in order to determine whether to send a reminder or thank you e-mail on subsequent weeks. Potential survey respondents were sent reminder e-mails each week until they either responded to the survey or data collection ended.

The correspondence and survey questions that were administered through the Virginia Tech Web Hosting Services survey research site (www.survey.vt.edu) can be found in Appendix E (in English) and Appendix F (in German).

The survey included qualitative and quantitative elements in order to more fully analyze the industry as a whole. For example, the online survey questionnaire included questions that identified the type of firm business model in use, questions that quantify the number and types of innovations the firm has begun or introduced, and questions that provide an indication of how successful the firm is compared to other firms in the veneer industry. This type of information greatly helped in recommendation development that will aid firms in being more innovative. The survey was pre-tested by 5 individuals from both Europe and the United States (for a total of 10 individuals) who were either veneer industry experts or representatives from hardwood veneer firms. Suggestions from these pretests were implemented when they didn't interfere with the theoretical backbone of the survey.

Each survey question related to a hypothesis and many of the questions were structured with 5-point Likert scale responses. For example, after the binary type question of whether or not the firm has begun or introduced a new method of production ('yes'=1 or 'no'=0), the categorical question of indicating how much the respondent agrees that innovating production methods is a goal of the firm (i.e., 'strongly disagree'=1, 'disagree'=2, 'neither'=3, 'agree'=4, or 'strongly agree'=5) was asked. The binary responses were used to determine whether or not that type of innovation should be included in the model. The nominal responses provided data to analyze using cluster analysis. This type of analysis created groupings of firms that represent similar innovation strategy types. Ward's minimum variance method was used to partition the data into groups naturally represented by the data. Once these groups were formed, a discriminant analysis was conducted on the data to determine if these groupings were valid. This type of data analysis helped to provide support for or against the hypotheses and insight into the innovation strategies in use in the veneer industry.

Survey results were used to substantiate information found during narrative interviews. Models developed to describe firms innovation strategies were compared and contrasted for US, Austrian, and German firms. Innovation strategies were also compared across the four types

presented by Afuah (2009) in an attempt to find patterns in the data that could more clearly explain the phenomena. Results from the survey can be found in Chapter 4.

Environmental Analysis

The identification of environmental factors within each of the five STEEP categories (i.e., social, technological, economic, ecological, and political) that impact innovation strategies occurred simultaneously with innovation strategy identification, namely during narrative interviews of veneer industry firm top management. A draft interview script and questions can be found in Appendix C (in English) and Appendix D (in German). Some of the questions that these interviews aimed to answer are as follows: Are there factors that impact the firm's innovation focus? If so, what might they be? Is the firm aware of social (or technological, economic, etc.) factors that might be impacting innovation in each of the five areas of innovation? Has the current economic situation impacted the firm? In what ways?

The Aeberhard (1996) method for global environmental analysis can be used to understand STEEP variables and their impact on the firm. The steps in this method are as follows:

1) Determine the elements of the environment that are necessary objects of analysis.

2) Concisely, yet precisely, describe the important events to date and the current situation for each of the elements identified in Step 1.

3) Develop a prognosis for the future of each element, whether quantitative or qualitative.

4) Analyze future development of the environment based on amalgamation of all elements' future state prognoses.

The narrative interviews of top management of firms and trade associations in Austria and the United States were aimed at completing Step 1 of the Aeberhard method. The elements of the environment necessary as objects of analysis were also identified or validated by way of narrative interviews with experts in each of the five environmental factor areas. These expert interviews helped complete Step 2 of the Aeberhard method and commence triangulation of causal linkages between veneer industry firm innovation strategies and environmental impacts. Step 3 of the Aeberhard method was also completed during narrative interviews of the experts, by asking the experts how they expected their area of the environment to change in the future.

During data collection via narrative interviewing, additional hypotheses were created that address the causal linkages between STEEP factors and innovation strategies. For example, top management of an Austrian firm described how the lack of new open source technology for slicing veneer has impacted production method innovation. It was hypothesized that veneer firms in the United States are experiencing the same situation and that it has encouraged them to innovate their production methods themselves. Further interviews of veneer industry firms in the United States indicated that other technologies, like supply chain or photographic technologies impact their innovation strategies as well. Survey questions were created for the census survey that tested which technologies are having an impact in Austria as well as Germany and which are having an impact in the United States. Each of the technologies was rated for the level of impact they are having on production method innovation. This information was used to test the hypothesis and substantiate information gathered from narrative interviews. The remainder of this section describes the data analysis that was completed on the survey results.

The survey data for STEEP factors was analyzed via cluster analysis. The survey to veneer industry firms listed questions regarding the environmental impacts to innovation with Likert scale response categories (i.e., 'strongly disagree'=1, 'disagree'=2, 'neither'=3, 'agree'=4, or 'strongly agree'=5) as to how much each firm agreed that the impact affected their firm. The Likert scale scores were analyzed using Ward's minimum variance test in SAS statistical analysis software. Companies responding in a similar way to the environmental impacts on innovation were grouped together in a 'cluster'. The resulting output will produce results similar to the depiction of Austrian/German survey results shown in Figure 6. This depiction of the results does not indicate the potential interactions of STEEP factors with the innovation strategies.

Simultaneous data collection and data analysis are imperative to establishing the causal relationships and identifying recommendations that the veneer industry firms or environmental experts may use to remove roadblocks to innovation. After surveys were collected and analyzed, returning to the literature to search for opposing viewpoints also helped to strengthen and explain the empirical findings.

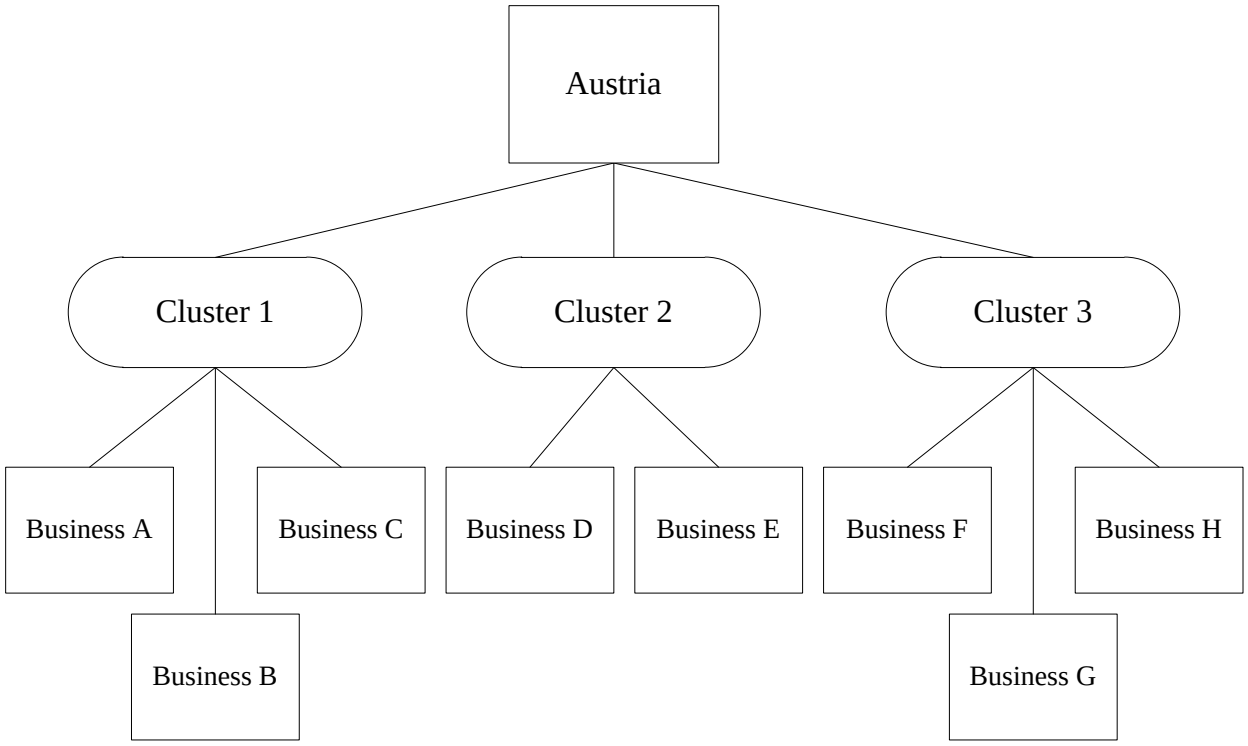


Figure 6. Hypothetical depiction of the research outcome

Recommendation Development

In order to develop recommendations for hardwood industry firms to navigate innovation efforts within the environment provided for them, information from interviews of firm management and experts were analyzed using qualitative data analysis techniques, including pattern matching. Survey results were also analyzed for quantitative support of the hypothesis testing. One method used for qualitative data analysis was a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis. For instance, the technological impacts to production method innovation were explored for opportunities to innovate and threats to innovation. One of the five environmental experts (i.e., political, economic, social, technological, and ecological), the technology expert, described their flexible equipment adaptation process that allows extensive customization of the product, indicating an opportunity for innovation that the customer can take advantage of. It was noted by the technology expert that this customization comes with a cost, indicating a potential threat to innovation where the customer has an idea but not the financial resources to implement it.

Some strengths and weaknesses are presented from an industry-wide perspective. Not all firms in the population can be described by the specific strengths and weaknesses. However many firms can insert their own strengths and weaknesses into the SWOT to adapt in their own way to the opportunities and threats identified from this research effort.

Following completion of SWOT Analysis, the insights created were used to generate recommendations for firms to maneuver the environment and create a competitive advantage. These recommendations took into consideration the innovation strategies present in the industry and the patterns identified from the results of this research. Recommendations for completing Steps 3 and 4 of the Aeberhard method of environmental analysis were provided for firms to complete based on their own innovation strategies and situations.

References

Aeberhard, K. (1996). Strategische Analyse, Empfehlungen zum Vorgehen und zu sinnvollen Methodenkombinationen. Bern, Switzerland: Lang Verlag.

Afuah, A. (2009). Strategic Innovation: New Game Strategies for Competitive Advantage. New York, NY: Routledge.

Andrews, K.R. (1971). The Concept of Corporate Strategy. Homewood, IL: Dow Jones-Irwin.

Boje, D.M. (1991). The storytelling organization: A study of story performance. *Administrative Science Quarterly* 36(1): 106-126.

Czarniawska-Joerges, B. (2007). Narrative inquiry in and about organizations. In: Handbook of Narrative Inquiry : Mapping a Methodology. D. J. Clandinin. Thousand Oaks, CA: Sage Publications. xix, 693 p.

Dey, I. (1993). Qualitative Data Analysis : A User-friendly Guide for Social Scientists. London, New York Routledge.

Dillman, D.A., J.D. Smyth, and L.M. Christian. (2009). Internet, Mail, and Mixed-mode Surveys : The Tailored Design Method. Hoboken, NJ: Wiley & Sons.

Eisenhardt, K.M. (1989). Building theories from case study research. *Academy of Management Review* 14(4): 532-550.

Gordon, J.C. (2007). Planning Research: A Concise Guide for the Environmental and Natural Resource Sciences. New Haven, CT: Yale University Press.

Hamel, G. and C.K. Prahalad. (1994). Competing for the Future. Boston, MA: Harvard Business School Press. E-book.

Harrigan, K.R. (1983). Research methodologies for contingency approaches to business strategy. *Academy of Management Review* 8(3): 398-405.

Miles, M.B. and A.M. Huberman. (1994). Qualitative Data Analysis. Thousand Oaks, CA: Sage Publications, Inc.

Rumelt, R.P. (1987). Theory, strategy, and entrepreneurship. In: The Competitive Challenge : Strategies for Industrial Innovation and Renewal. D. J. Teece. Cambridge, MA: Ballinger Pub. Co. 137-158.

Sapsford, R. (1999). Survey Research. Thousand Oaks, CA: Sage Publications.

Webster, L. and P. Mertova. (2007). Using Narrative Inquiry as a Research Method : An Introduction to Using Critical Event Narrative Analysis in Research on Learning and Teaching. New York, NY: Routledge.

Yin, R.K. (2009). Case Study Research : Design and Methods. Los Angeles, CA: Sage Publications.

Chapter 3: Strategic Innovation in the Wood Products Industry: A Case Study of the Hardwood Veneer Industry

Introduction

The wood products industry has been adversely impacted by the downturn in the housing market. The trickle down effects to the primary wood products industry are evidenced by employee layoffs, facility closures, and bankruptcies. The hardwood veneer industry is a primary wood products industry that is a perfect example of this phenomenon. In his economic theories of development and business cycles, Joseph Schumpeter (1939; 1968) identified the importance of innovation to pull firms out of cycles of recession and depression. While commonly perceived by hardwood veneer industry representatives as lacking innovativeness, the hardwood veneer industry has shown signs of attempts to recreate the theoretical situation described by Schumpeter. This research explores the strategies hardwood veneer industry firms use to innovate.

Innovation research in the wood products industry has historically focused on factors internal to the company. Innovation studies have been conducted on the innovativeness of large versus small companies (Wagner and Hansen, 2005), innovation culture in organizations as a product of management approach (Crespell and Hansen, 2008), innovation in the furniture industry in China (Cao and Hansen, 2006), and general studies on the innovativeness of the wood products industry (Hansen, 2010; Quesada-Pineda, 2010). Theories of competitive strategy describe the various competitive forces impacting firms, including customers, suppliers, and competitor firms. These viewpoints neglect to incorporate factors of the external environment that the entire industry is impacted by, including social, technological, economic, ecological, and political (known as STEEP factors). In order to encourage innovation, it is not currently understood how industry firms can adapt their strategies to take account of the environment their industry must operate within.

The aim of this study was to determine how the external industry environment characterized by the STEEP factors, impacted the innovation strategies of companies in the hardwood veneer industry. Studies have not been conducted on the innovation strategies in use within the forest

products industry using Schumpeter's more comprehensive five-factor model, nor have they focused on the hardwood veneer sector of the wood products industry. In this study, interviews were conducted of hardwood veneer company management as well as experts in each of five environmental areas in Europe and the United States. Through qualitative analysis, a theory of the impacts of environmental variables on innovation in the hardwood veneer industry is proposed.

Literature Review

A generally accepted idea is that innovative firms are more competitive in their market segments than less innovative firms (Porter, 1990). Studies have also shown that innovative capabilities directly impact the sustained competitive advantage of companies (Lee and Hsieh, 2010). In the resource-based view of the firm, sustained competitive advantage is achieved through creation or ownership of inimitable, rare, valuable, and non-substitutable resources (Barney, 1991). By definition, innovations have qualities associated with each of these attributes that provide firms with an initial competitive advantage. The source, the number of distinct sources of advantage and constant upgrades and improvements of innovations often dictate whether or not that advantage is sustainable (Porter, 1990).

Theories of innovation differ in the number of ways in which firms can innovate. Schumpeter (1939), perhaps the first to suggest how firms could be innovative, identified five areas of innovation, namely sources of supply, methods of production, markets, products or services and organizational forms. The Organization for Economic Co-operation and Development (OECD) (2005) identified four types of innovation in the Oslo Manual, namely: product, process, marketing and organizational. Boer and During (2001) identified three main areas of innovation: products or services, processes and business systems. Innovation research in the wood products industry has been conducted using models with three (Hovgaard and Hansen, 2004; Crespell and Hansen, 2008) and four areas of innovation (Quesada-Pineda, 2010). Prior experience with the hardwood veneer industry suggests that companies view their firms from Schumpeter's perspective, where value is added into the firms' products and services from procurement to production to sales, and that a business model dictates these activities. Therefore, Schumpeter's theory of innovation was tested in this research in order to capture the

supply chain oriented view of hardwood veneer industry firms. The definition of innovation that was used in this study is:

> to begin or introduce a source of supply, method of production, market, organizational form or product or service that has not previously been used by the firm in question.

Due to the common perception within the hardwood veneer industry is that it entirely lacks innovation, many firms believe they do not have an innovation strategy. Mintzberg and Waters (1985) proposed that a strategy could be either a deliberate attempt at achieving a goal, or the emergent outcome of a firm's activities. It is suggested that innovation strategies lie somewhere on a continuum from purely deliberate to purely emergent, though the extremes are said to be improbable. If a company makes any attempt at beginning or introducing something new in one of the five areas of innovation, it can be considered to have a deliberate strategy. Schumpeter differentiated inventions from innovations, noting that an invention is the creation of something new and an innovation is the attempt at market capitalization through implementation of the invention (Schumpeter, 1939). One characteristic of firms in capitalist economies is an attempt to gain profits from the production of goods and services. Thus, if an invention is recognized during the daily operations of a firm in a capitalist economy, the firm will attempt to capitalize on it. The implementation of this invention would be an innovation. Therefore, by the very definitions of capitalism and innovation, every firm has at least an emergent innovation strategy.

In the daily operations of a company, two dimensions help determine its competitive advantage: the resource and capability dimension of the company is responsible for serving the market and customer dimension (Afuah, 2009). In the resource-based view (RBV) of the firm, the internal resources and capabilities are used to develop and provide favorable benefits to customers and to use these benefits to capture market share from competitors (Afuah, 2009). In the product-market-position (PMP) view of the firm, the benefits to customers and the firm's position compared to coopetitors indicates the firm's ability to achieve higher rates of return than competitors (Afuah, 2009). Using these ideas, Afuah (2009) proposed four strategies for innovation that firms can employ in order to gain competitive advantage through use of the resources/capabilities and markets/customers dimensions: 1) regular, 2) resource-building, 3) position-building or 4) revolutionary.

Afuah calls these innovation strategies 'new games' and defines them as activities a company may use to create and capture value (Afuah, 2009). A regular new game strategy uses existing resources/capabilities to develop new products that do not greatly influence the competitiveness of existing products on the market. Contrarily, a revolutionary new game strategy uses newly obtained or created resources/capabilities to develop products that displace existing products in the market by rendering them obsolete, thus creating new markets or serving new customers. A position-building new game occupies the strategic position of low obsolescence of existing resources and capabilities to develop products that displace existing products in the market. Finally, a resource-building new game uses new resources and capabilities to develop products that do not greatly influence the competitiveness of existing products on the market. This research explores the presence of these new games in the hardwood veneer industry, and the impacts to them from the firm's external environment.

External firm factors of the environment extend beyond the boundaries of the firm and even beyond the interactions with companies immediately surrounding the firm (i.e., customers, suppliers and competitors). The environmental factors at play in this study were identified as social, technological, economic, political (Christensen et al., 1973) and ecological (Andrews, 1999) or natural (Afuah, 2009) in nature[3]. Social factors are those pertaining to individual and group interactions, human rights, and changing demographics. Technology includes the discoveries of science, the impact of related product development, the less dramatic machinery and process improvements, and the progress of automation and data processing (Andrews, 1999). Political factors include relationships between private entities and government, workers and managers, rich and poor countries, as well as national planning and corporate planning (Andrews, 1999). Economic factors are those involved with trade development in foreign countries, globalization, inflation, the recurrence of recession, and industry structure changes in foreign countries (Andrews, 1999). Ecological factors, also called physical factors, include physical environmental characteristics favorable to industrial development, transportation, location of the production facility and changes in environmental quality (Andrews, 1999).

Current research on the wood products industry does not explore the external firm factors of the environment that impact innovation. It would be difficult for companies to take advantage of

[3] Porter (1990) identified these five factors as shifters of competitive advantage that cause innovations.

opportunities to create a competitive advantage or to defend themselves against threats posed by the external environment without understanding the role these environmental factors play in impacting their innovation strategy. This research explores the ways in which these environmental factors impact innovation strategies of hardwood veneer firms.

Objectives

Innovation strategies are an important element of creating a competitive advantage for wood products companies. The hardwood veneer industry is a part of the wood products industry facing severe competitive pressures that would greatly benefit from an understanding of the innovation strategies they are using and how they can be tailored to create a competitive advantage given the impacts of external environmental factors. Therefore, the primary objectives of this research are to:

1) investigate the strategies hardwood veneer firms use to innovate, and

2) identify environmental factors that impact their innovation strategies.

Some questions that were used to guide this research are:

1) Is Schumpeter's theory of innovation exemplified by the hardwood veneer industry?

2) Do hardwood veneer companies describe their innovation strategies as emergent/deliberate?

3) Do hardwood veneer companies describe their innovation strategies in terms of the resources/capabilities and markets/customers used?

4) Are hardwood veneer companies able to identify factors beyond their suppliers, customers, and competitors that impact their innovativeness?

During the investigation of innovation strategies, it will be determined whether or not firms identify all of Schumpeter's areas of innovation as areas their firms have innovated. It will also be determined if these firms have a more deliberate or emergent strategy and into which of the four categories identified by Afuah (2009) the firm's strategy seems to exemplify. The

identification of environmental factors that impact the innovation strategies will include a pursuit of whether or not firms seem to be looking beyond their immediate business interactions to the entire industry environment. Cross-validation of expert interviews and company top management interviews will help to determine which environmental factors are indeed impacting the firm's innovation. The goal of this investigation is to produce results from which theoretical constructs relevant for determining how hardwood veneer firms can adapt their innovation strategies to capitalize on the impacts of their external environment can be obtained through further testing of industry firms.

Methods

When faced with answering 'how' or 'why' questions, case study research is an excellent method for use on contemporary events that do not require the event to be controlled (Yin, 2009). As compared to single case designs, multiple case designs are considered to be more robust (Herriot and Firestone, 1983) and to increase generalizability and testability to a larger population (Eisenhardt and Graebner, 2007). Eisenhardt (1989) developed a guide for generating theory from multiple case studies, which suggests the use of theoretical sampling to build theory. Theoretical sampling is the selection of cases having characteristics believed to be evidence of the specific relationships and constructs under examination during the study (Eisenhardt and Graebner, 2007). When using theoretical sampling, each case is considered a replication, in order to make fruitful comparisons among the constructs within a case and across cases (Eisenhardt and Graebner, 2007).

This study was conducted using a multiple case study method of five hardwood veneer companies from both the United States and Austria (ten companies in all). Theoretical sampling of six different types of veneer companies was used (i.e., small, single facility veneer producers; single facility veneer and other product producers; custom-slicing companies; veneer departments of large corporations, multi-facility veneer producers located in a single country; large, and multinational veneer producers), and interviews were conducted with top management of each company. An effort was made to interview representatives from two companies of each type (one from the US and one from Austria), but this was not always possible. In addition, veneer trading companies were not included in the interviews because their source of supply is different than all the other companies interviewed (i.e., veneer, not veneer logs). It should also

be noted that these groups are not mutually exclusive, but the companies were grouped by their primary business type (i.e., greater than 50% of their business activities). A list of the dates the interviews were conducted for each country can be found in Table 4. Company types are withheld to protect the respondents, as the size of the industry is quite small (i.e., there are approximately 35 companies in the United States, 14 companies in Austria, and 60 companies in Germany). About 9% of all veneer companies within the United States and Austria were interviewed. Interviews lasted from 30 minutes to 2 hours, were conducted in person whenever possible and often included a tour of the firm (which helped glean some information about innovations from interviewees).

Table 4. Interview dates of types of veneer companies in Austria and the United States

Company type	Country	Date of Interview
Type 1	Austria	August 14, 2009
	United States	July 27, 2009
Type 2	Austria	August 11, 2009
Type 3	Austria	August 9, 2010
	United States	June 17, 2010
Type 4	Austria	August 4, 2009
	United States	July 16, 2010
Type 5	United States	October 5, 2010
Type 6	Austria	July 20, 2009
	United States	July 27, 2010

The storytelling interview method was used to obtain a perspective from each manager about a time when the company began or introduced each of the five innovation types (i.e., source of supply, method of production, market, product or service and business model). The storytelling method of narrative inquiry provides the interviewer of a qualitative study a natural account of an event or action in order to obtain a perspective about the event or action and to capture the elements of an event or action that are critical to the plot of the story (Czarniawska-Joerges,

2007). In order to gain a more complete picture of the innovation stories, probing questions were used to obtain information about whether or not the innovation (or lack thereof) was a goal of the firm, and what actions were taken to capitalize on it (i.e., innovation strategy type). These questions were asked to identify each innovation as deliberate or emergent and by innovation strategy type, respectively. Subsequently, top managers were asked to elaborate on what the greatest external influences were on searching for each innovation type. The interviews were tape-recorded and transcribed for qualitative data analysis.

To ensure adequate data was collected for theory generation from the multiple case studies, multiple data collection methods and controlled opportunism were used by overlapping data collection with data analysis while in the field (Eisenhardt, 1989). During interview data collection, company websites and literature obtained from the companies were used to gather information about the companies' strategies and tendencies for innovating in certain areas. Interviews were transcribed and transcripts were condensed by writing descriptions of the main constructs under investigation, including the emergent or deliberate nature of the innovations by each company in each area of innovation, the strategy type exhibited for each type of innovation, and the environmental factors that had the greatest impact on each type of innovation. The information obtained from websites and other company literature was incorporated into these condensed written descriptions. Yin (2009) suggests this approach of writing descriptions that identify the main units of analysis embedded within each case to guide the data analysis so that patterns can be identified in the data that rely on the theoretical propositions used in the initial case study design to answer the research question.

After within-case analysis was complete, cross-case comparisons were made to search for patterns within the data as described by Eisenhardt (1989). Comparisons of quantitative and qualitative data embedded within the cases were made between the United States and Austrian cases as recommended by Yin (2009). Thus, counts were created and compared of the emergent and deliberate innovation strategies, the innovation types, and the environmental impacts to innovation. Qualitative comparisons were made on the main units of analysis in the US and Austrian cases, namely the approach companies took to innovate in each area, examples of types of innovations, as well as external barriers to and facilitators of innovation. It is during this stage that hypotheses were generated for testing in subsequent steps of this research project.

Literature on conflicting theories were then examined and enfolded before finally reaching closure on theoretical refinement of the hypotheses (Eisenhardt, 1989). Yin (2009) describes this as defining and testing rival explanations to the theoretical propositions of the case. In addition to literature, one method used to explore and cross-validate the nature of the relationship between the environmental areas and each type of innovation was interviews of experts in each area of innovation. Five interviews in the United States and Austria were conducted with representatives from government, trade associations, or private companies that were selected based on their intimate knowledge of the hardwood veneer industry and one of the environmental areas (ten interviews in all). The environmental experts were asked to describe the largest impact from their environmental area to each type of innovation. These interviews were also recorded and transcribed for qualitative data analysis. Table 5 provides a list of the type of experts interviewed and the dates they were interviewed.

The outcome of the interviews was a list of hypotheses that could be used to explain the impacts of the external firm factors on the innovation strategies of hardwood veneer companies. The results from the data analysis can be found in the results section and the hypotheses can be found in the discussion section. These results provided the theoretical constructs to test in a subsequent step of this research project involving a survey of the entire hardwood veneer industry in the United States, Austria and Germany.

Table 5. Interview dates of environmental experts from the United States and Austria

Expert type	Country	Date of Interview
Political	Austria	July 28, 2009
	United States	October 18, 2010
Ecological	Austria	July 29, 2009
	United States	October 1, 2010
Social	Austria	September 8, 2009
	United States	October 15, 2010
Technological	Austria	July 20, 2009 August 2, 2009
	United States	July 26, 2010 August 2, 2010
Economic	Austria	July 15, 2009
	United States	July 30, 2010

Results of Innovation Strategy Identification

Quantitative Results

The first step involved in innovation strategy identification was testing Schumpeter's theory of innovation on the hardwood veneer industry firms. Company representatives were asked to identify a time when their firm innovated in each of the five areas of innovation identified by Schumpeter, namely sources of supply, methods of production, markets, products and services, and business models. The innovation stories for each area of innovation were tested against the definition of innovation to determine if they should be counted, and the valid responses were tallied among all interview respondents. Each company could tell more than one story for each area of innovation, and thus there are more valid responses noted than there were companies interviewed. (All subsequent data analysis includes only the valid responses.)

A summary of the responses can be found in Table 6, and a pie chart showing the breakdown of these responses into each innovation area can be found in Figure 7. The pie chart represents

these count data as percentages of the total number of innovations from all innovation areas that company representatives mentioned. It is important to note that the data only reflect the innovation stories told by company representatives interviewed, and are not representative of all the innovations by these companies. Valid responses were noted within each of Schumpeter's five areas of innovation. In addition, four companies were able to give a valid response for each of the five areas of innovation. The most common innovation story type was for business model innovations, with 25% of all stories being of this type. Some interviewees had difficulty coming up with sources of supply innovations, so it is the least common innovation story type. A small amount of bias is expected in this data as a result of three company respondents who were not top management of the companies. In the case of these three individuals, it is expected that the number of innovation stories told was slightly lower than the number of stories told by top management.

Table 6. Summary of responses by company representatives of valid innovation stories

Geographic Region	Test Statistic	Number of valid responses across all respondents
All companies	Mean	6
	Median	5
	Mode	4
	Maximum	11
	Minimum	2
Austrian companies	Mean	6.4
	Maximum	11
	Minimum	3
US companies	Mean	5.6
	Maximum	10
	Minimum	2

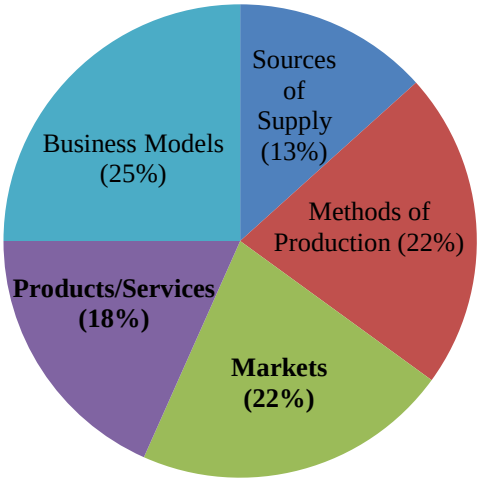


Figure 7. Percentage of each innovation area represented in all innovation stories told by interview respondents

The innovations in each innovation area described by company representatives during the interviews were then tallied by country, and can be seen in Figure 8. These results are depicted as a percentage of the total number of innovations described by respondents in Austria and in the United States. In total, Austrian company representatives described slightly more innovations than US company representatives. Austrian firms tended to cite more examples of product or service innovations than American firms, while American firms tended to cite production method innovations more often.

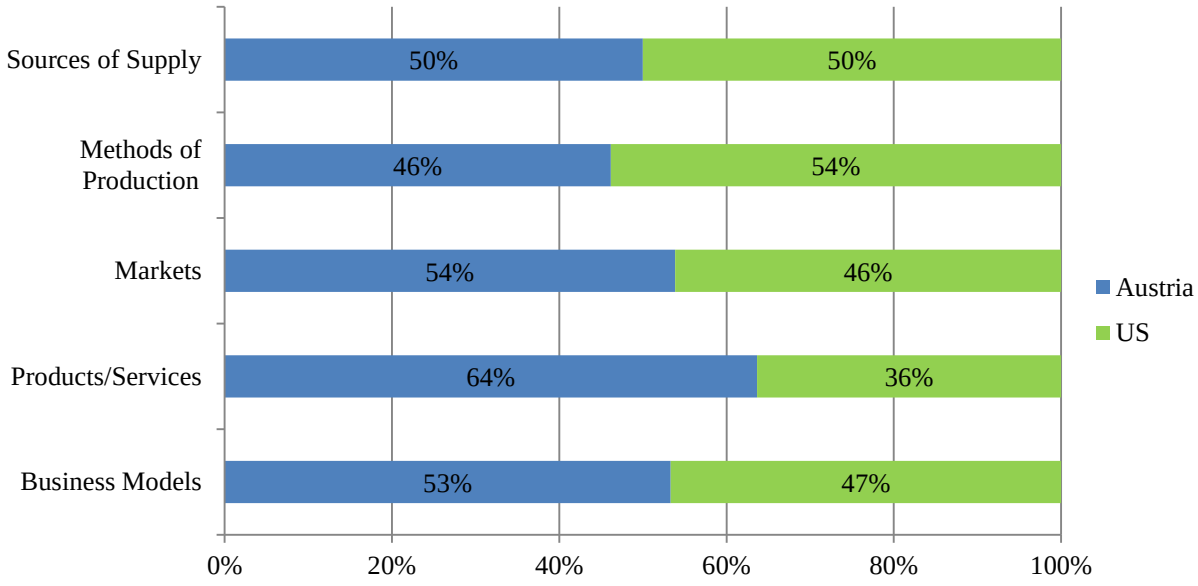


Figure 8. Percentage of stories for each innovation type told by Austrian and US respondents

A subsequent analysis conducted on the transcribed interviews was aimed at quantifying the attempts to innovate in each innovation area as deliberate or emergent. Interview transcripts were analyzed to determine whether the interview respondent described their innovations as something the company made a conscious effort to do, or whether the innovation came about as a reaction to a circumstance or stimulus. Each innovation story told by interview respondents was identified as "more emergent than deliberate" (denoted 'emergent') or "more deliberate than emergent" (denoted 'deliberate'). Strategies were categorized in this way as it is rare to get purely emergent or deliberate strategies (Mintzberg and Waters, 1985). The results in Figure 9 show the number of companies that told stories determined to be 'emergent' or 'deliberate' for each of the five areas of innovation.

These results indicate that the US companies interviewed make a more deliberate attempt to innovate in each area of innovation than the Austrian hardwood veneer companies in the study. Eighty percent of valid responses from US companies indicated a deliberate attempt to innovate was made, while only 52% of Austrian companies made a deliberate attempt. Overall, the interviews showed that two-thirds of the hardwood veneer companies interviewed deliberately innovate, with the remaining one-third of companies using a more emergent innovation strategy. In addition, these hardwood veneer companies make deliberate attempts to innovate in all areas

of innovation, with 60% or more of innovations in each innovation area described as deliberate. This is opposed to a more reactive approach at innovation that takes advantage of innovative ideas emerging from the daily operations of the company. Eighty percent of all innovations in products and services and seventy percent of all business model innovations were deliberately attempted.

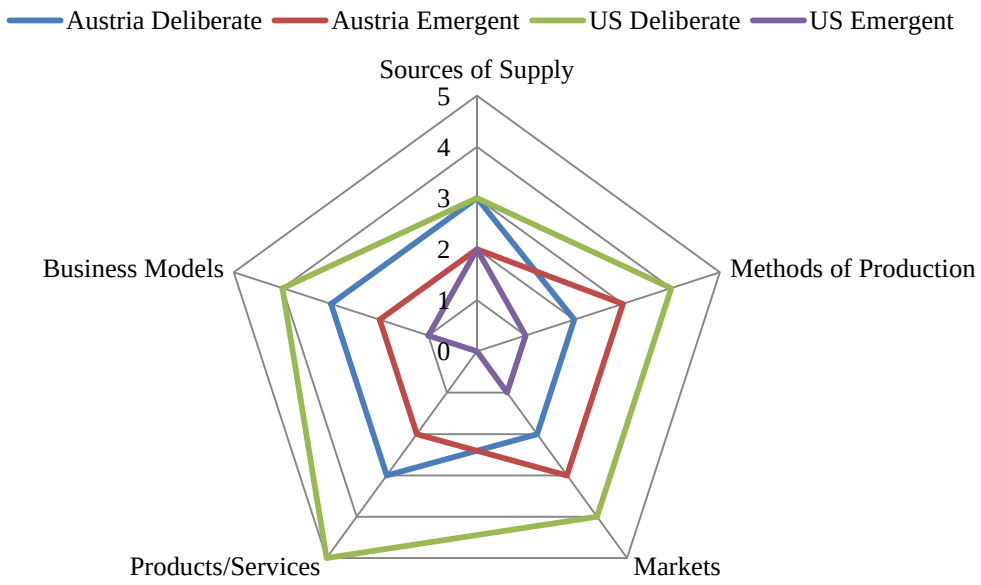


Figure 9. Number of companies exhibiting deliberate versus emergent innovation tendencies for each innovation area in Austria and the US

Qualitative Results

The transcripts were subsequently analyzed to qualify the trends identified in the quantitative analysis. The main units of analysis were identified based on the research questions. For example, types of innovations identified by company management were identified in each transcript and added to a list called 'Examples of Innovation'. The main units of analysis used to identify the innovation strategies were: examples of innovation, reasons for innovating and means of innovating. Means of innovating were categorized as market/customer or resource/capability oriented means of innovating in a particular area of innovation.

The predominant innovation type described by all interview respondents was business models. Some examples of business model innovation include resizing, relocating, company restructuring, merging, acquiring or entering joint ventures with other companies. In terms of resources and capabilities of the companies, the business models developed were often implemented to optimize the organization in a way that would allow for focusing on core competencies, creating synergies among different business units, or offering new products or services. Some of the market or customer-based decisions related to implementing a new business model were also often scope or scale related decisions, such as resizing to meet market demand, or relocating to capitalize on economic factors of production (due to customer demand for cheaper products), to be nearer to a certain consumer base or to improve their chances of reacting quickly to market changes. Companies that innovated in this area described the innovation as occurring as a result of market pressures to maintain consistency of quality, production volume, and/or product selection. In some instances, the move was a competitive strategy to prevent competitors from gaining more market share in certain markets.

Production method innovations and market innovations were the next most common types, with almost 22% of the innovations cited being from these types. In terms of production method innovation, some examples cited were incremental improvements made to existing machinery or development of brand new machinery. The resources and capabilities used by these companies were either new to the company (i.e., open source technology producers, universities, etc.) or existing (i.e., skunkworks teams within the company). Companies that collaborated with an open source technology producer (i.e., slicing equipment manufacturer or supply chain technology firm) to develop new machinery stated the innovations were later adopted by other firms in the industry. Some companies instead collaborated with local universities to develop new production methods, or relied on internal groups of employees to make equipment improvements or develop new techniques for producing new products, reducing costs or improving product quality. One of the most common types of innovations companies cited to improve the efficiency of their production was supply chain equipment. Many firms viewed this as a primary source of their competitive advantage. Companies cited pressure to create new markets, serve new or existing customers, or existing market demands for quality as reasons for production method innovations. It is also interesting to note that given the labor intensive nature of production for the product of veneer, some companies have tried to produce machines that

reduce the number of workers needed in certain areas of production. Several companies divulged information about inventions in these areas that were adopted and failed, or were never adopted because of their impracticability.

Market innovations were implemented in terms of geographical areas where veneer was new to secondary wood manufacturing firms, in terms of applications where veneer had never been used before, and in terms of species that were new to markets where veneer already competed. Nearly all companies lamented the difficulties of developing new markets and of entering existing markets. In terms of the resources and capabilities veneer companies had to use or create, partnerships, use of agents, membership in networks or trade associations, and other industry affiliations were among the most important resources. Other resources and capabilities that were cited as important in innovating markets included the company's quality philosophy, marketing capability, certification status, and ability of the company to source enough of the product. In terms of the market and customer dimension of market innovations, customer/market appreciation for certain veneer qualities, return customer base, and designers' impact on species use were most notable influences. Some companies noted the veritable fashion cycles that certain species exhibit as evidence that there are no new markets for veneer. Others stressed the importance of close relationships with customers to understand these market signals and supply the market appropriately.

Almost 19% of all innovations cited by companies were product or service innovations. These new products and services were sometimes the result of another innovation or came in combination with it. For example, the identification of a new source of supply often created a new product for the firm, or a new production method was developed to provide the means of producing a new product or offering a new service. Examples of product and service innovations that were often cited by company management included vertical and/or virtual integration, both of which aimed to diversify product or service offerings to customers. Some interview respondents argued that veneer is always the product and that all species of wood are known, thus there can be no product innovations. However, evidence suggests the contrary. Most of the product innovations involved a different initial raw material to be sliced than logs of common species. In addition, several interview respondents indicated that they introduced a species not commonly known to be produced into veneer and it was highly accepted by the customer. Some

of the resources and capabilities used in the creation of product or service innovations included the ability of the sales force to grade veneer, flexibility as a supplier, inventory holding capacity, stability of price and qualities, boundary scanning capabilities, ability to explore new ideas, promotion, and flexible procurement. The market and customer dimension included new products to serve underserved markets, greater usability of veneer that catered to customer demands, understanding of customer needs (in terms of repeat customer base and designers/architects) and services that save time and money for the customer. Common new service examples provided include special veneer grading for customers, and use of technology to minimize costs incurred through the ubiquitous practice of customers visiting the plant to go through pallets of veneer in order to select the qualities and quantities needed for their production.

Approximately 13% of companies indicated innovation of their sources of supply of raw materials or half-manufactured goods. There are very different perspectives of what entails a raw material for the companies interviewed. Sources of supply could mean anything from logs to the veneer itself, depending on scope of the firm. Firms that innovated in this area tended to cite new species that differed from their current offerings, or new suppliers from either a different region of the world or of new types of raw materials as their primary modes of innovating in this area. Several companies indicated the need for a source of supply innovation to precede a market innovation, and that the source needs to be cheaper or better than existing sources in order for it to be a viable innovation. Some of the resources and capabilities mentioned as important for an innovation in this area include ability to source materials, supplier networks, internal sourcing policies that dictate product standards, marketing capabilities, synergies created by procurement structure, and certification status. Some of the main market and customer drivers of source of supply innovations include market acceptance, customer segmentation, demand for species and quality, and changing fashions.

Results for Environmental Factor Impacts

Quantitative Results

Top management of Austrian hardwood veneer firms were asked to describe an external factor that influenced their innovation or lack thereof in each of Schumpeter's five areas of innovation.

These factors could be social, technological, economic, ecological or political in nature, and numerous impacts to each area could be described. Each factor described by a company representative was classified as one of the five environmental factors based on the definitions and examples for each factor presented in the literature review. A summary of the responses can be found in Table 7, while Figure 10 shows a breakdown of the responses by environmental factor. The average number of environmental factors mentioned by company representatives across all geographic regions as impacting the innovation of their firms was 8.5. Economic factors were most often cited as impacting innovation in the firm, while the impacts of political factors were least often cited.

Table 7. Summary of responses by company representatives of environmental impacts to innovation

Geographic area	Test statistic	Number of impacts
All companies	Mean	8.5
	Median	8.5
	Mode	8
	Maximum	12
	Minimum	3
Austrian companies	Mean	7.6
	Maximum	10
	Minimum	3
US companies	Mean	9.4
	Maximum	12
	Minimum	7

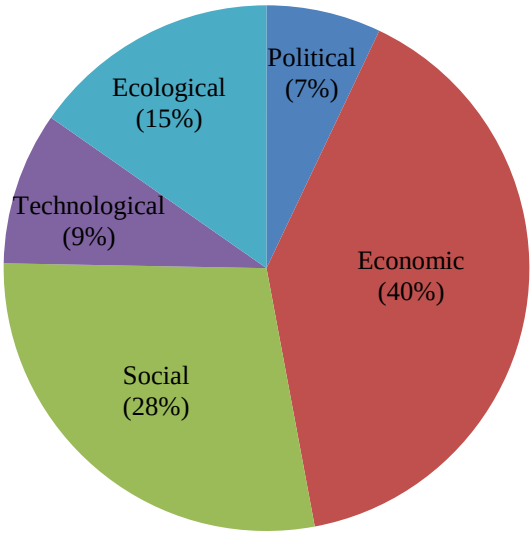


Figure 10. Percentage of number of impacts to all areas of innovation from each environmental factor for both Austrian and US interview respondents

When broken down by country, economic factors played a greater role in impacting innovation in hardwood veneer firms in the United States, while social factors played the greatest role in Austrian veneer firms. This breakdown can be seen in Figure 11. Economic factors include currency exchange rates, taxes and the global economic crisis. Social factors include the changing product demands by consumers for quality, appearance, and other fashion-related characteristics.

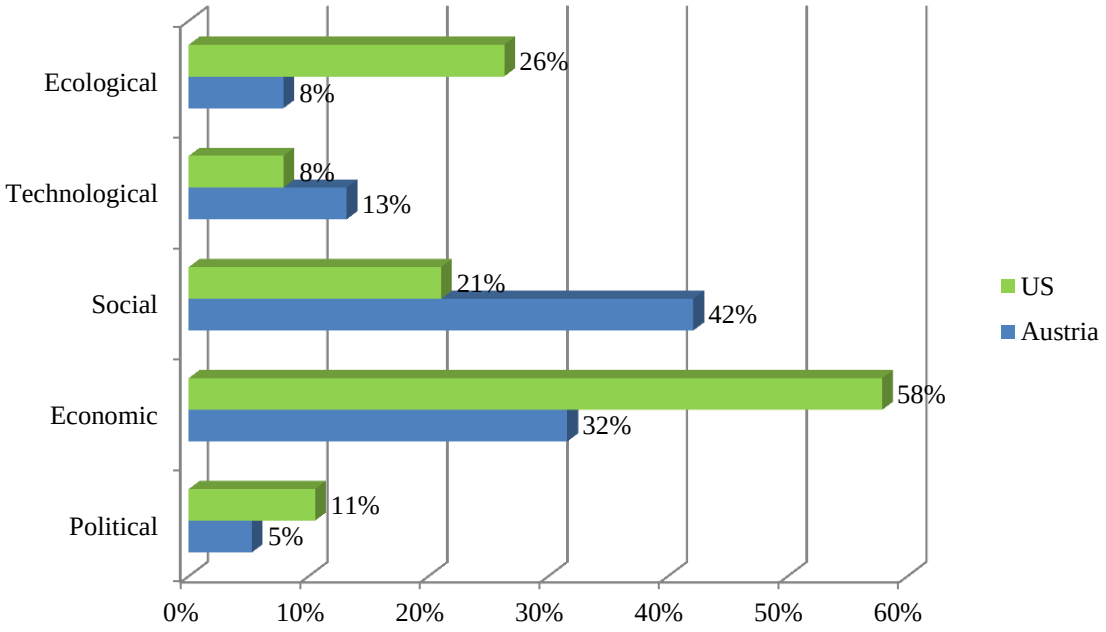


Figure 11. Percentage of impacts to innovation from each environmental area described by the Austrian and US company representatives interviewed

Each innovation area is impacted differently by the environment the veneer industry exists within. Table 8 and Table 9 show that for both Austria and the United States market innovations are most impacted by the external environment. However, in Austria, economic and social factors seemed to be more greatly impacting markets. The dynamic nature of consumer preferences within markets and economic factors of production such as differing labor costs in the eastern and western European countries were some of the factors often indicated by Austrian interviewees as impacting market innovations. In the United States, economic and ecological factors were most often cited as impacting market innovations. These included things like changing currency exchange rates and company location as a source of competitive advantage in terms of access to markets and sources of raw materials, respectfully.

Table 8. Percent of environmental factors noted to impact each innovation area by Austrian interview respondents

Innovation Area	Austria					
	Political	**Economic**	**Social**	**Technological**	**Ecological**	**Total**
Sources of Supply	0%	5%	8%	0%	3%	**16%**
Methods of Production	0%	5%	5%	8%	3%	**21%**
Markets	3%	11%	11%	0%	0%	**24%**
Products/Services	3%	3%	11%	3%	0%	**18%**
Business Models	0%	8%	8%	3%	3%	**21%**
	5%	**32%**	**42%**	**13%**	**8%**	**100%**

Table 9. Percent of environmental factors noted to impact each innovation area by US interview respondents

Innovation Area	United States					
	Political	**Economic**	**Social**	**Technological**	**Ecological**	**Total**
Sources of Supply	4%	11%	4%	0%	6%	**26%**
Methods of Production	2%	4%	4%	4%	2%	**17%**
Markets	2%	11%	4%	0%	11%	**28%**
Products/Services	0%	9%	2%	0%	0%	**11%**
Business Models	0%	13%	2%	2%	2%	**19%**
	9%	**47%**	**17%**	**6%**	**21%**	**100%**

Qualitative Results

In terms of economic factors at play in the hardwood veneer industry, both Austrian and US firms cited the economic crisis in the United States as the primary factor impacting their firms. Some of the common themes expressed by veneer industry management in relation to economics include efficiency of production, cost effectiveness, currency exchange rates and price (of either raw materials or end products). Economic factors were noted to have impacted every single type of innovation by at least one company in both Austria and the United States.

Across both regions, social factors had the greatest impact on markets and products and services. Companies cited consumer preferences for product characteristics (i.e., quality, species, etc.), customer relationships or brand recognition as important social factors that impacted their

innovativeness in these innovation areas. Other social impacts to the remaining innovation areas were illegal logging and timber theft, customer service orientation, language barriers, differing cultural norms impacting how business is conducted, rights of workers, and customer demands for flexibility and consistency.

Technological factors were most often cited as production method impacts. Many firms cited the lack of innovation in open source technologies as the driving force behind their own development of new supply chain or production technologies. In addition, the adoption of technological advances in photographic equipment, web-based resources, and communication aids have been described as assisting market innovations as well as product and service innovations.

Ecological factors were more often cited in the United States than Austria as impacting innovation. Firms described how their location near to hotspots for the architectural, door or furniture industries impacted their decisions to change their business models (i.e., mergers takeovers, etc.). Some firms also described how availability of raw materials impacted their search for new sources of supply or even impacted their introduction of new markets (because if there is not adequate supply, there is little market potential for a product).

Political factors were the least cited factors impacting innovation in both Austria and the United States. The most often cited examples were regulations for trade of wood species and regulations impacting the types of raw materials used in production or the sustainability requirements for types of products used in buildings.

The innovation areas least impacted by the environment differed for the American and Austrian firms. Company representatives in the United States cited products and services as being least impacted by the environment. The impacts to product and service innovations in the United States were primarily economic in nature. US interview respondents raised concerns about imports deeming domestic production uncompetitive as a driving force for innovation of products and services, as well as cost saving measures as a reason to innovate services for customers. In Austria, product and service innovations were more greatly impacted by the environment, specifically by social, political, economic and technological factors. Social factors played the greatest part in product and service innovation, with product and service quality

impacts most often described. Changing regulations, the economics of travel as opposed to providing online communication services to customers and technology-aided product quality control measures were other factors cited as impacts to product and service innovation in Austria.

The least impacted innovation area in Austria was sources of supply, while this was the second greatest impacted innovation area for the US companies. In Austria, social factors such as illegal logging and log quality as a translation of consumer demands for veneer quality were both indicated as important. The economics of raw material costs in one country versus another, as well as the location and availability of the log supply were also important economic and ecological factors for Austrian firms. In the US, economic issues like currency instabilities, exchange rates and cost of raw material supplies were the greatest impacts on identifying and using new sources of supply. Other impacts identified were availability and seasonality of raw materials, regulations on importing certain species and politics surrounding environmentally conscientious sourcing, and cultures and customs of local people where raw materials might be sourced.

Business models were slightly more impacted in American companies than Austrian companies. The impacts to business models in the US were predominantly economic in nature, and included issues like pressures to be more efficient and cost effective, reductions in workforce due to the economic crisis, maintaining economic stability, and preventing competitive efforts to capture economic returns. Other factors impacting business model innovation in the US were based on consumer demands, location of the firm to offer the best prices, and inadequate technology to continue a relationship with another firm. In Austria, the environmental impacts to business model innovations were centered more around social and economic factors, such as customer demands on price, consistency of production, and flexibility.

Lastly, in terms of methods of production, companies from both countries cited an equal amount of environmental impacts. The same issues of quality and customer service being a focus of the firm that impacted their production, as well as the lack of adequate open source technology to adopt that lead to production technology innovations were described from both American and Austrian company management. Some companies in the US also noted that new production

methods needed to be cost effective in terms of yield and quality, and that often these new production methods were cheaper to produce in-house than working with firms supplying open source technology. Therefore some companies had worked with local universities to help them develop the technology necessary for their production.

It should be noted that many of the respondents had difficulty coming up with one of the STEEP factors, citing instead factors external to the firm such as competitors within the hardwood veneer industry, external industry competition, substitute products, customers or suppliers as being impacts to their innovation. When we consider the image of a target, where the firm is the center of the target; competitors, customers, and suppliers are on the first level out from the center; and the STEEP environmental factors are on the second or outermost level; it is possible that the respondents are impacted more greatly by the first level influences. However, it is also possible that the respondents simply don't look beyond their industry competitive situation in the first level to the overall environmental situation, or second level influences. Some specific examples of STEEP factor influences on innovation raised by company representatives during interviews can be found in Table 10.

Cross-validation with Expert Interviews

Experts in each of the five environmental (STEEP) areas were identified from trade associations, government agencies, and the private sector in the United States and Europe and interviewed to determine the environmental factors that are impacting innovation hardwood veneer companies in both geographic regions. The expert interview transcripts were used to cross-validate the results of the qualitative analysis on veneer company management interviews. The main unit of analysis of expert interviews was impacts to innovation. This cross-validation was used to provide affirmation of the company interviews, and to help provide additional reasons for innovating that could be used during the next phase of this research project (i.e., survey to veneer companies in Austria/Germany and the United States). A table describing some of the impacts to innovation mentioned by the environmental experts can be found in Table 11.

Table 10. External environmental impacts to innovation raised by veneer company representatives during interviews

Environmental Area	Selected Impacts to Innovation Raised
Political	• Taxation policies of a country caused a change in suppliers • Political implications of using certified raw materials
Economic	• Housing market crisis impact on veneer markets • Forced to change business model due to increased taxes • Currency instability and exchange rates forced a change in suppliers • Low product pricing can cause a search for a new market • Prices of imports caused domestic products to be uncompetitive
Social	• Evidence of illegal logging changed a source of supplies • Consumer demand for quality impacts products and services supplied • Worker safety rules changed production methods • Language barriers impacted how a company entered new markets • Labor markets in foreign countries impact suppliers used
Technological	• Value addition of products due to incremental machinery innovations • Lack of adequate supply chain technology on the market caused company to create their own • Technology used caused a business model to fail • Partnership with a technology company to create a new production method
Ecological	• Availability of certified raw materials impacted sourcing • Search for market potential in different geographic regions • Permanent location in a country can be a barrier to entering new markets • Product availability impacted use of certain suppliers

Environmental experts described business model innovation as largely driven by profitability. Companies take actions based on the needs they see exhibited in the marketplace. When a need for a product or service is identified, the company identifies if it has the resources to fulfill this need. The need may be an existing need (i.e., quantity of supplies is less than the quantity required to fulfill demand) or a new need (i.e., no quantity or type of supplies exist to fulfill demand). If not, changes to the supply chain system, manufacturing system, or marketing system may be required. Before companies make these changes, they determine if the changes will be profitable and they react accordingly.

Table 11. External environmental impacts to hardwood veneer industry innovation raised by environmental experts

Environmental Area	Selected Impacts to Innovation Raised
Political	• Export trade policies impact domestic sourcing of logs • Trade association marketing efforts have created new markets for the industry • Regulatory environment can make companies more competitive globally
Economic	• Affordability of domestic raw materials • Availability of capital for production method improvements • Collaborations with universities to create new production methods • Global economic crisis impacting search for new markets
Social	• Ensuring worker safety allows firms to be more competitive • Adapting to changes in consumer preferences changes company organization • Raw material quality expectations differ
Technological	• Use of supply chain technology can change a company's organization to generate more value • New products or services can be created through technological advances • Use of open source supply chain technology causes production method improvements and efficiencies
Ecological	• Availability of certified logs • Adoption of forest certification provides product diversification for companies or can be considered a new service

Economic experts interviewed were public sector employees involved with the impacts of national economic policies on the forest products industry. The global economic crisis was noted by both economic experts as having a great influence on all types of innovation in the hardwood veneer industry. In fact, it was noted that the trickledown effects from the housing market crisis could be identified in all other wood products sectors, including those that use wood veneer. Other economic factors mentioned by the experts that impact innovation in the hardwood veneer industry are: decreased demand for wood veneer due to cheap price of substitute products may bring cost of veneer logs down; favorable tax laws have a positive impact on innovation (while unfavorable tax laws can cause businesses to move off-shore);

international trade (i.e., import/export tariffs) has an impact on log availability; domestic tax policies impact the planning horizon of businesses; capital availability impacts the creation of new production methods and/or investment in new property, plant and equipment; and industry scale (and thus substantial capital) determines whether or not the industry is strong enough to innovate. Two economic differences between the United States and Europe were noted by the economic experts, namely higher labor costs in Europe than the US, and thinner slices of veneer by European veneer producers than in the US (thus maximizing the economic output from each log).

Social experts interviewed were individuals involved with labor unions or occupational health and safety in the wood products industry. Social experts described a need by consumers to know where veneered products come from and information regarding their sustainability. Consumers seem to be more in tuned to purchasing products that are not produced with child labor or from illegal timber, as well as from companies who are concerned with worker health and safety. Unions are a factor in some areas that impact how companies fulfill these expectations, which in turn are guided by the International Labor Organization (ILO) and forest certification schemes (i.e., Forest Stewardship Council [FSC], Program for the Endorsement of Forest Certification [PEFC], etc.). Certification of wood products is gaining popularity and recognition among consumers. In addition, consumers have more discerning tastes regarding quality and species of wood products purchased.

Ecological experts interviewed were employed by forest certification organizations dealing with the entire wood products industry or the hardwood veneer industry specifically. Experts in the ecological aspects of hardwood veneer production indicated that certification is increasingly becoming a factor that impacts where these companies source their raw materials, how their products are manufactured (i.e., tracking systems used), and product labeling when the products are sold. In terms of sourcing raw materials, identifying log suppliers who sell certified logs can be a concern due to the low number of acres of forest land certified (See Appendix G). Certified products need to be tracked to ensure authenticity of the claims made on the labels of the final product, so impacts to production methods might include storage and tracking of these products separately from non-certified products while in the veneer production facility. The tracking methods used by a veneer company might also help streamline the company's production.

Ecological experts both emphasized the potential for certified products to be considered new markets and to be helpful in terms of a veneer company finding new customers. Certified products are also considered to enhance the normal product features a veneer company would provide (i.e., manufacturing quality standards, species selection, etc.) and could even be considered a service provided to their customers. At this point in time, the ecological experts saw certification as a new business model, but one that would not provide incredible returns on the investment. However, emphasis was placed on the increasing value of certification on the market and the potential for increased opportunities to sell certified products.

Technological experts interviewed were employed by supply chain and slicing technology firms supplying products specifically for the hardwood veneer industry. Supply chain technology is used within the veneer industry to aid decision making in all areas of the company, from the products and services the company offers, to the business model which drives how they are offered. The information gathered by supply chain technology can cause a veneer company to search for new suppliers who provide the qualities and species of logs they deem most efficient for their production. Advances in slicing technology have also impacted the suppliers veneer companies source their logs from, due to the ability to more efficiently slice tapered logs, thus increase the quality range of logs allowed. Production methods can be optimized by both slicing and supply chain technology, and supply chain technology can provide information that enhances customer relationships to help develop or impact the search for new markets. In addition, experts agreed that advances in both slicing and supply chain technologies can boost profits and cause changes in the way veneer companies operate (i.e., business model changes).

The political experts interviewed for this research were both employees of industry supported lobbying organizations involved in either international or national level government. Current legislation in both the United States and Europe that greatly impacts how all wood products companies supply logs entails the identification of the true source of wood entering the country/continent. This legislation aims at curtailing illegal logging at a global level, and prevents companies from importing logs from uncertain origins (that may have been illegally harvested). In terms of production method innovations, there is legislation that either provides funding for research on production technologies or funding for companies to expand their operations to be more competitive. Both political experts agreed that market innovations may be

greatly impacted by trade policies, either import policies for domestic markets or export policies that may impact foreign markets. In Europe, check-off type programs are illegal, but in the United States, check-off programs might be one way industries can promote their products and impact markets (i.e., the veneer could perhaps collaborate with other producers of hardwood products in this effort). Both of these experts describe their efforts in creating a level playing field amongst domestic producers of veneer and hardwood products. In the United States, one issue that might also impact the business model of a veneer company is the ability to obtain capital to restructure, expand, or relocate (i.e., legislation dealing with loans provided to manufacturing companies). In addition, there are some regulations dealing with product standards in the United States that more greatly impact secondary wood products manufacturers, but might impact how veneer is used by these companies.

There were a number of impacts to innovation that were mentioned by both company representatives and environmental experts. Additional impacts were noted, yet Table 12 combines only the impacts mentioned by both a company representative and an environmental expert, regardless which country the interview respondent was from. For each innovation area, two impacts were selected from each environmental area. These 25 impacts were used in a survey in a subsequent step of this research.

Table 12. Environmental impacts to innovation that were tested in the survey

	Sources of Supply	Methods of Production	Markets	Products and Services	Business Models
Political	• Export trade policies • Lacy Act	• Product regulatory require-ments • Federal tax policies	• Trade association global marketing efforts • Government policies	• Product sustain-ability legislation • Federal tax policies	• Legal lending restrictions • Current govern-ment regulations
Economic	• Exchange rates • Cost of logs	• Lack of available capital • Partnerships with universities	• Global economic crisis • Currency exchange rates	• Cheap imported products • Global economic crisis	• Global economic crisis • Labor costs
Social	• Language • Consumer quality expect-ations	• Need for safer working environment • Workforce demo-graphic changes	• Consumer product preferences • Cultural differences	• Consumer quality demands • Changing global demog-raphic	• Ensuring worker safety • Consumer demand changes
Technology	• Supply chain tech advances • Slicing tech advances	• Slicing tech meets needs • Supply chain tech meets needs	• Tech advances outside the industry • Supply chain tech	• New technology • Supply chain tech advances	• New tech creation or adoption • Supply chain technology use
Ecological	• Availability of logs • Availability of certified logs	• Product or market location changes • Proximity to competitors	• Location as competitive advantage • Industry size	• Location of my company • Forest certifi-cation adoption	• Forest certify-cation adoption • Lean manu-facture adoption

Discussion/Conclusions

Schumpeter's five factor model of innovation was tested in this research, and it was found that companies were able to express their innovativeness in terms of each of these five factors. The relationship exhibited among the five factors was described most clearly by an economic expert. Products and services produced by a company are created to fulfill a need in the marketplace. The supplies, manufacturing methods, and marketing used to provide these products and services are guided by a business model. The driving force behind the business model is profitability. These relationships are modeled in Figure 12.

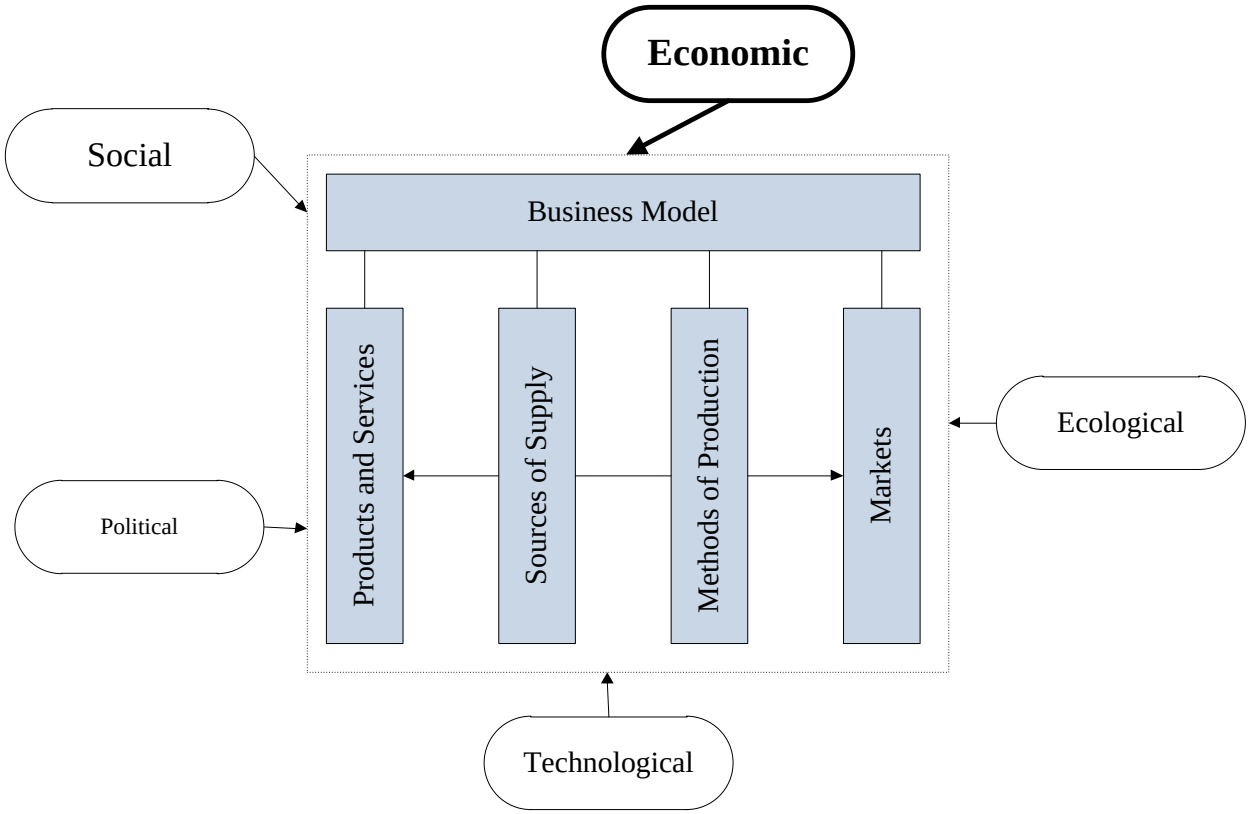


Figure 12. Model of relationships among environmental factors and areas of innovation in the hardwood veneer industry

The impact the environmental factors have on innovation can be described as a positive or negative relationship. An environmental factor may negatively impact one area of innovation while positively impacting another area. Expert interviews also revealed an interesting relationship between the different factors of the environment. Each of the environmental experts suggested some kind of interaction with their field of expertise and another environmental factor.

The strength of these interactions was not noted or measured in this research. However, future studies could be conducted to reveal more about the intermingling nature of these interactions. The graphic in Figure 12 shows a hypothetical relationship each of the environmental factors has with the areas of innovation. The environmental factors form a sort of matrix within which the hardwood veneer firm must attempt to innovate in each of the five areas of innovation proposed by Schumpeter. The size of the text of the environmental factors is meant to depict the amount of impact that environmental factor has on the innovativeness of the company.

In the second part of the data analysis, qualitative data were analyzed to determine if the companies interviewed described their innovations as deliberate or emergent. These results were then quantified and reported in the results section. It was found that hardwood veneer companies make more deliberate attempts to innovate in all areas of innovation than they just allow innovations to emerge through the daily operations of the company. It was also found that US companies seem to make many more deliberate attempts at innovating than Austrian companies did.

These results are not surprising because of the highly competitive nature of a small industry like the hardwood veneer industry. Competition for veneer quality logs is high; for example sawlog inventory of the northeastern US harbors less than 1 percent of veneer quality logs (Hoover and Gann, 1999), and substitute products (like laminates and digitally printed low quality veneer) compete for limited market share (Anonymous, 2009). This would cause companies to deliberately search for new sources of high quality veneer logs, new production methods to make the most efficient use of the logs they are able to obtain, new markets and customers to improve their market position, and new ways of organizing to increase profits.

In addition, the mature market situation of the hardwood veneer industry encourages firms to innovate in order to maintain their relevancy as an industry, maintain competitive positions of individual firms, and to attempt to gain new competitive advantages. Austrian firms were able to describe more innovations than US firms, particularly in the areas of product and service innovations. However, they did not describe these innovations as things they attempted to do because they were more emergent in nature. In contrast, US firms innovated their production methods more frequently. From these results, it is recommended that companies in both regions

use various tactics to attempt more innovation. Austrian firms should make conscious attempts to innovate their business models instead of focusing on products and services to gain more sustainable competitive advantages (Alon and Chow, 2008; Giesen et al., 2007). US companies might also shift their focus more towards business model innovation, as well as finding more opportunities to market their innovativeness. Companies on both continents might consider leveraging core competencies into new industries or finding new external partners for collaboration in terms of knowledge and technology transfer.

The next part of the data analysis involved investigating the innovation strategies of hardwood veneer companies from a market/customer and resource/capability orientation. A qualitative data analysis was conducted to determine that companies were able to describe the means of innovating in each of Schumpeter's five innovation areas from these two orientations. Individual companies were not categorized into the four innovation strategy types described by Afuah (2009) in this part of the study. However, a subsequent part of this study will allow individual companies to self-report their belief of exemplifying one of the four innovation strategy types, and their responses to a survey on their innovation habits will be used to categorize them into an innovation strategy type. This information will provide insight into how companies can change the market/customer and/or resource/capability orientation of their company to be more innovative in order to weather the impacts from the external environment to be more competitive.

The next part of the research study involved identification of the environmental factors that impacted the innovation strategies of the companies interviewed. The results indicate that firms were able to look beyond their customers, suppliers and competitors to name factors external to their immediate industry environment that impact their innovativeness. Following quantification of the impacts to determine the greatest impacts to firm innovativeness, it was determined that US firms experienced a greater impact from economic factors, while Austrian firms experienced greater impacts from social factors. Firms in both regions noted the economic crisis as the primary economic factor impacting their firms. American firms were most detrimentally impacted by the crisis (perhaps as a result of the timing of interviews for this research compared to Austrian firm interviews), and the economic environmental experts noted that the US market is import driven so that firms could not export their way out of it. American firms faced the

question of how long they could maintain their businesses without being profitable. American firms indicated the most economic impacts to business models, followed by sources of supply and markets. Because the innovation area of production methods was least among the least impacted by environmental areas, American firms also described most of their innovations as being in this area. It is possible that innovations of production methods could improve production efficiencies that in turn reduce costs.

In contrast, Austrian firms were more greatly impacted by social factors in terms of markets and products/services, as well as economic factors in terms of markets. Given Austrian veneer companies' geographic proximity to many different cultural trading partners (see Table 1), their impacts from social factors like language barriers and differing product and service demands of consumers created a need to purposefully adapt product and service offerings to meet the needs of other cultures. Austrian firms are deliberately more innovative in product and service innovations than American firms in order to react to the dynamic demands of consumers for veneer quality, character and species in these geographic markets. Austrian firms additionally cited the economic crisis begun in the United States housing market as a major economic impact to their innovation.

In a mature industry scenario, companies innovate to develop new competitive positions that aim to sustain growth. Innovating in areas where firms are experiencing the most impacts from environmental factors would help create sustainable competitive advantages. American hardwood veneer companies would be wise to change their innovation strategies to more deliberately innovate in their business model, source of supply and market areas to remove the economic disadvantages imposed by the environment. Austrian firms exhibit more emergent than deliberate market innovation strategies, and would benefit from meeting the social and economic impacts with a more deliberate approach.

The results of the environmental impacts to innovation were summarized in Table 12. The impacts listed in the table were used as propositions in the next step of this research. The propositions were written as statements and tested among all firms in the hardwood veneer industry.

References

Afuah, A. (2009). Strategic Innovation: New Game Strategies for Competitive Advantage. New York, NY: Routledge.

Alon, A. and D.D. Chow. (2008). How to get the most from your best ideas. Outlook Accenture. Retrieved January 2, 2010 from: http://www.accenture.com/Global/Research_and_Insights/Outlook/default.htm.

Andrews, K.R. (1999). The concept of corporate strategy. In: The Strategy Process : Concepts, Contexts, Cases. H. Mintzberg, J. B. Quinn and S. Ghoshal. London, UK: Prentice Hall. 51-60.

Anonymous. (2009). Personal communication. August 13, 2009.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management* 17(1): 99-120.

Boer, H. and During, W.E. (2001). Innovation, what innovation? A comparison between product, process and organizational innovation. *International Journal of Technology Management* 22(1,2,3): 83.

Cao, X. and Hansen, E.N. (2006). Innovation in China's furniture industry. *Forest Products Journal* 56(11/12): 33-43.

Christensen, C.R., Andrews, K.R., et al. (1973). The company and its environment: Relating opportunities and resources. In: Business Policy : Text and Cases. Homewood, IL: R. D. Irwin. xvii, 846 p.

Crespell, P. and Hansen, E.N. (2008). Managing for innovation: Insights into a successful company. *Forest Products Journal* 58(9): 6-18.

Czarniawska-Joerges, B. (2007). Narrative inquiry in and about organizations. In: Handbook of Narrative Inquiry : Mapping a Methodology. D. J. Clandinin. Thousand Oaks, CA: Sage Publications. xix, 693 p.

Eisenhardt, K.M. (1989). Building theories from case study research. *Academy of Management Review* 14(4): 532-550.

Eisenhardt, K.M. and Graebner, M.E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal* 50(1): 25-32.

Giesen, E., S.J. Berman, R. Bell, and A. Blitz. (2007). Paths to success: Three ways to innovate your business model. IBM Global Business Services. Retrieved June 20, 2009 from: http://www-935.ibm.com/services/us/index.wss/ibvstudy/gbs/a1028552?cntxt=a1005266.

Hansen, E.N. (2010). The role of innovation in the forest products industry. *Journal of Forestry* 108(7): 348-353.

Herriot, R.E. and Firestone, W.A. (1983). Multisite qualitative policy research: Optimizing description and generalizability. *Educational Researcher* 12(2): 14-19.

Hoover, W.T. and Gann, R.W. (1999). Indiana forest products price report and trend analysis. West Lafayette, IN: Purdue University Cooperative Extension.

Hovgaard, A. and Hansen, E. (2004). Innovativeness in the forest products industry. *Forest Products Journal* 51(4): 26.

Lee, J.-S. and Hsieh, C.-J. (2010). A research in relating entrepreneurship, marketing capability, innovation capability and sustained competitive advantage. *Journal of Business and Economics Research* 8(9): 11.

Mintzberg, H. and Waters, J.A. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal* 6: 257-272.

OECD. (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. Organization for Economic Co-operation and Development, Eurostat, European Commission.

Porter, M.E. (1990). The Competitive Advantage of Nations. New York, NY: The Free Press.

Quesada-Pineda, H. (2010). Innovation activities in the primary wood products sector: A case study. *Wood and Fiber Science* 42(4): 511-522.

Schumpeter, J.A. (1939). Business Cycles : A Theoretical, Historical, and Statistical Analysis of the Capitalist Process. New York, NY: McGraw-Hill Book Company, Inc.

Schumpeter, J.A. and Opie, R. (1968). The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Cambridge, MA: Harvard University Press.

Wagner, E. and Hansen, E.N. (2005). Innovation in large versus small companies: Insights from the US wood products industry. *Management Decision* 43(5/6): 837-851.

Yin, R.K. (2009). Case Study Research : Design and Methods. Los Angeles, CA: Sage Publications.

Chapter 4: Characteristics of Innovation in the Hardwood Veneer Industries of the United States, Austria and Germany

Introduction

The hardwood veneer industry is a small subset of firms in the wood products industry that plays an important part in the wood products supply chain. Hardwood veneer firms use the highest quality hardwood logs to produce their products, and in turn provide a valuable source of product differentiation for loggers, sawmills, and other wood products firms. In addition, the quality and characteristics of veneer inputs to secondary wood products manufacturing firms can be the make-or-break element of a consumers' perception of an end product.

Despite the importance of the hardwood veneer industry, it is a mature industry and possesses all the characteristics of a mature industry which can be detrimental to its growth and vitality. The industry faces high variability in the costs and qualities of raw material inputs, a lack of change in the technology used to produce veneer and move it through the supply chain, decreasing market share as a result of lower cost/consistent quality substitute products, lack of revolutionary change in product quality or characteristics valuable to the consumer, and little variety in the methods companies use to compete in a challenging environment.

It is within cycles of depression and recession that changes must be made to business models, products and services, production methods, markets and sources of raw material supply in order for companies to develop new competitive advantages (Schumpeter, 1939). The aim of this research is to identify the current state of innovation in the hardwood veneer industry, and provide insight into the impacts the external environment has on innovation strategies of industry firms. The results from a prior case study on the hardwood veneer industry were used in this research to develop a survey instrument that was administered to top management of hardwood veneer companies in the United States, Austria and Germany. Quantitative data analyses were used to test hypotheses developed from the case study.

Literature Review

Results from a case study conducted on the hardwood veneer industry were used to develop this study. The case study consisted of interviews with top management of six different types of hardwood veneer-related businesses and experts working in five different environmental areas

(i.e., political, economic, social, technological, and ecological areas) impacting the hardwood veneer industry. The case study identified four different types of innovation strategies in use in the hardwood veneer industry, the names and theoretical underpinnings of which are described in Proposition 4. Innovation areas identified in the hardwood veneer industry were sources of supply, methods of production, markets, products and services, and business models; with the latter being the most prevalent amongst all companies surveyed. The environmental factors that seem to be impacting hardwood veneer firms were described, of which social factors most impacted Austrian and German firms, while economic factors most impacted US firms. The results of this case study were used to develop a survey, with which the hypotheses described in this study were tested among hardwood veneer industry firms in Austria, Germany, and the United States.

A method of theory generation from case studies developed by Eisenhardt (1989) and case study methods supplemented by Yin (2009) were used as the theoretical backbone to generate from the case study a set of propositions about the innovation strategies in use in the hardwood veneer industry and the environmental factors that impact them. There are many propositions which could have been tested through this research, but seven main propositions regarding company innovativeness were chosen. The theoretical background and insight from the case study antecedent to this research are given here.

A strategy is an intermediary between the firm and its environment. Firms use boundary spanning activities to acquire information about changes, events and relationships in the external firm environment to assist in planning a future direction for the firm's activities (Aguilar, 1967). Strategies are formed for a variety of different purposes. Sauber and Tschirky (2006) defined an innovation strategy as a strategy that defines the course, concentrates efforts, permits organizational design and makes certain systems for innovating remain constant while considering various factors of innovations including barriers, newness and the necessary pertinent knowledge. Innovation in this sense is defined as the creation or use of new business models, products and services, markets, production methods and sources of material supply in response to the cyclic nature of the economy (Schumpeter, 1939).

A preliminary case study to this research indicated that there is a perception within the hardwood veneer industry that industry firms are not innovative. This perception may be driven by the fact

that in mature industries like the hardwood veneer industry, product and process standardization has occurred, and changes occur more slowly than in early stages of the industry lifecycle. It is also characteristic of mature industry stages to exhibit a theory of the industry lifecycle called routinized technological regime, in which new ventures are less innovative than established firms (Winter, 1984). Given the mature industry situation of the hardwood veneer industry, this result is expected. However, social science literature suggests that survey respondents will aim to please the researcher by responding to questions in a manner that they believe to be socially acceptable. This phenomenon, called social desirability bias, can decrease the validity of the responses, though less significantly in real world problems as in hypothetical problems (Norwood and Lusk, 2011). Given the purpose of this survey as a means of identifying innovation strategies in use in the hardwood veneer industry, survey responses are expected to also exhibit social desirability bias, and thus indicate a higher level of innovativeness than is truly present by the firms. Thus, the first proposition of this study is:

P1) Younger hardwood veneer companies believe they are more innovative than older firms.

There are different types of strategy formation, ranging on a continuum from emergent to deliberate, with existence of the extremes being highly unlikely in organizations (Mintzberg and Waters, 1985). In the previous case study to this research, 80% of US and 52% of Austrian hardwood veneer companies told innovation stories that described a deliberate attempt was made to innovate. Due to this result, it is proposed that:

P2) Hardwood veneer companies make deliberate attempts to innovate.

While the various theories of the types of innovation differ, Joseph Schumpeter's theory of innovation is used in this research, which identifies five types of innovation as business models, products and services, markets, production methods and sources of material supply (Schumpeter, 1939). A case study conducted on the primary wood products manufacturers by Quesada-Pineda (2010) indicated that firms did not select a strategic direction in terms of the area of their innovative activities. The study further mentions that new product development and process improvement categorized most of the innovations mentioned by those firms (Quesada-Pineda, 2010). In the case study precursory to this research, 40% of the hardwood veneer companies

studied indicated that they had innovated in all five innovation areas. Given that most companies have not innovated in all five areas, the third proposition is:

P3) Companies do not innovate in each of the five areas of innovation.

A business model is a way of organizing a company that generates value through determination of the scale and scope of the company's activities. A business model is also a type of innovation strategy that can act as an intermediary between the company's competitive environment and the activities of the firm. Companies included in the case study precursory to this research indicated that the area of the company most often innovated was their company's business model. Companies cited value generation activities like creating synergies among business units and focusing on core competencies in order to respond to the environment through resizing, relocating, company restructuring or other activities. This idea will be tested via survey research in this study.

P4) Business model innovations are the most prevalent type of innovation.

There are two innovation strategy types that were combined for use in this research. Abernathy and Clark (1985) proposed innovation strategy types that follow two continuums, one of technology/production and one of market/customer. These innovation strategy types are:

1) Regular: Use of existing technologies in existing markets or on existing products.
2) Revolutionary: Use of new technology on existing products and markets.
3) Niche creation: Use of existing technologies to open new markets.
4) Architectural: Use of new technologies on new products or in new markets.

Afuah (2009) proposed similar innovation strategies, called new games. These new games are described in terms of how existing or new resources/capabilities make existing or new products/markets obsolete. Each of the new games are described below:

1) Regular: A new game that uses existing resources/capabilities to create new products which take market share from existing products.
2) Resource-building: A new game that uses new resources/capabilities to create products which make existing resources/capabilities useless.

3) Position-building: A new game in which existing resources/capabilities are used to create new products that make existing products on the market obsolete.
4) Revolutionary: A new game in which new resources/capabilities are used to create new products which leave both existing resources/capabilities and existing products obsolete.

Abernathy and Clark (1985) identify technologies as the driving force behind the strategy, while Afuah (2009) characterizes the strategies by the level of obsolescence of resources/capabilities used and products on the market. These theories were combined for this research to determine innovation strategies used by hardwood veneer companies based on their use of existing or new resources/capabilities in existing or new products/markets. Companies were allowed to self-report this measure because of the varying resources, capabilities, products and markets that could be defined as variables. In a subsequent part of this research, some of the resources identified by experts and top management interviews were used to characterize different groups of firms exhibiting seemingly similar innovation strategies. This is beyond the scope of the current study. However, due to the previous perceptions of the industry as not innovative and exhibiting a mature industry situation, we will assume that companies are using existing resources and capabilities to make products to sell in existing markets.

P5) Companies use existing resources in existing markets.

Innovation can be impacted by five main external environmental factors: social, technological, economic, ecological and political factors. Social factors of the external business environment refer to the changing demographics of society, language and other cultural factors, and consumer preferences. Technological factors include machinery and process improvement, automation and mechanized data processing. Economic factors of the environment can be the effects of globalization, foreign trade developments, and structural changes of industries in emerging countries. Ecological factors refer to physical factors of the environment, like geographic location, transportation logistics, and environmental quality. Finally, political factors consist of the regulatory environment within which an industry functions, including national policy planning as it relates to corporations, relations between workers and management and government and businesses. Understanding the changes in each of these external environmental factors can be important in terms of identifying opportunities to innovate.

The economic environment during which this research has been conducted is subsequent to a housing market bubble burst, the impacts of which have trickled down to detriment the entire forest products industry. The hardwood veneer industry has not been spared. This is evident in the results of the case study that economic impacts to innovation were considered the greatest of all impacts cited by top management. In the United States, the economic impacts seemed to most greatly impact firms' business models, while in Austria, economic factors most impacted markets. Currency exchange rates and prices of end products were cited as reasons for market impacts. This study will test how the overall innovation strategy is impacted by all environmental factors, but will propose that economic factors produce the greatest impact on the study population.

P6) Innovation strategies of companies are impacted most by economic environmental factors.

The case study identified the innovation type being impacted the most by the environment as market innovations. As previously mentioned, the primary impacts to markets were from economic environmental factors. However, social factors like consumer preferences for product quality, species, and other characteristics, as well as brand recognition were mentioned as driving impacts to market innovations. Ecological factors like inadequate raw material supply resulting in a lack of market potential for a product were also mentioned by company top management interviewees. The evidence suggests that market innovations will be most impacted by the environmental factors for the entire population of hardwood veneer companies.

P7) Environmental factors have the greatest impact on innovation of hardwood veneer markets.

Objectives

The objectives of this study are to:

1) Describe the innovation strategies in use in the hardwood veneer industry,

2) Compare the innovation strategies of hardwood veneer firms in the United States and Austria/Germany, and

3) Describe the response of hardwood veneer companies to their environment.

The propositions generated from case study analysis of a theoretical sample across company type of hardwood veneer companies were used to guide this research. Items from the interviews of top management of hardwood veneer firms in Austria and the United States were used to create a survey to obtain data for this study. The goal of this investigation is to produce results from which a model of impacts to innovation in the hardwood veneer industry can be obtained.

Methods

Survey Research

In order to determine the innovation strategies in use by firms in the hardwood veneer industry and to understand which environmental factors are most impacting them, survey research was used to collect information about the firms' innovation behaviors and the demographics of the respondents. The Tailored Design Method recommended by Dillman et al (2009) was used to develop the survey instrument in a way that reduced four main types of error: coverage, sampling, nonresponse and measurement. Each of these types of error is addressed in the remainder of this section.

Sampling Methods

The survey population consisted of hardwood veneer manufacturers, traders or agents, and custom slicing companies. A census in Germany, Austria and the United States was attempted as the sample frame due to the small size of the hardwood veneer industry in these countries. Hardwood veneer industry firms in the United States and Austria were of primary interest for this study. German firms were included as a convenience sample due to similarities with the Austrian hardwood veneer industry in terms of language used and the large number of German hardwood veneer firms that could improve the robustness of the Austrian data. The assumption

was made that companies from these countries would provide similar results. Industry contact information was obtained from publicly available information sources (i.e., trade association databases, industry websites, etc.) as well as privately obtained information (i.e., word of mouth). Initial contacts with this population via e-mail and telephone provided a sample. An attempt was made to obtain contact information for the president of the company or a respondent within the company that would be most knowledgeable about decision-making within the firm. Firms were included in the study sample if they were still in business, their primary business activity involved manufacturing or selling decorative hardwood veneer, and they had a viable e-mail address. Snowball sampling, a method of gaining contact information for additional companies in an industry by asking each company sampled for the names of their competitors, was conducted to aid in obtaining a comprehensive list of these companies to reduce sampling error. Three companies were included in the sample as a result of using snowball sampling.

The sample size necessary to obtain precise results for the population of hardwood veneer companies in the United States, Austria and Germany was calculated based on the following formula:

$$N_s = \frac{(N_p)(p)(1-p)}{(N_p - 1)(B/C)^2 + (p)(1-p)}$$

Where:

N_s= the completed sample size for a given precision level

N_p= population size

p = proportion of the population expected to respond

B = margin of error (recorded as half the confidence interval width)

C = Z score associated with the desired confidence level

The population size of hardwood veneer firms in the United States (36 companies), Austria (20 companies) and Germany (61 companies), was determined by the methods previously mentioned and confirmed with outside sources like Wiedenbeck et al. (2004) and Veneernet.com (2010). The proportion of the population expected to respond to this research was 25% based on adjusted

response rates reported in previous wood products industry research (Smith et. al, 2009). A Z-score of 1.96 is desired, which indicates a 95% confidence level, and a margin of error of 10%. Thus the completed sample size should be 45 companies, with 14 companies in the United States, 8 in Austria, and 23 in Germany.

Due to the international nature of the hardwood veneer business and the prevalence of the Internet (i.e., access to e-mail), an e-mail survey was deemed to provide adequate coverage of the population to achieve the necessary sample size while easing survey administration.

Survey Creation

The survey items were selected based on case study results conducted with hardwood veneer industry representatives in Austria and the United States and environmental experts in Europe and the United States. Only items mentioned by both an expert and an industry representative were included. Two impacts to each of the five innovation areas were selected from each of the five environmental factors for a total of 50 survey items (see Table 13). Demographic questions were included to gain greater insight about the industry and innovative characteristics of the firms. The survey instrument can be found in Appendix E (in English) and Appendix F (in German).

Table 13. Environmental impacts tested in the survey

	Sources of Supply	Methods of Production	Markets	Products and Services	Business Models
Political	• Export trade policies • Lacy Act	• Product regulatory requirements • Federal tax policies	• Trade association global marketing efforts • Government policies	• Product sustain-ability legislation • Federal tax policies	• Legal lending restrictions • Current government regulations
Economic	• Exchange rates • Cost of logs	• Lack of available capital • Partnerships with universities	• Global economic crisis • Currency exchange rates	• Cheap imported products • Global economic crisis	• Global economic crisis • Labor costs
Social	• Language • Consumer quality expectation	• Need for safer working environment • Workforce demographic changes	• Consumer product preferences • Cultural differences	• Consumer quality demands • Changing global demo-graphics	• Ensuring worker safety • Consumer demand changes
Technological	• Supply chain tech advances • Slicing tech advances	• Slicing tech meets needs • Supply chain tech meets needs	• Tech advances outside the industry • Supply chain tech	• New technology • Supply chain tech advances	• New tech creation or adoption • Supply chain technology use
Ecological	• Availability of logs • Availability of certified logs	• Product or market location changes • Proximity to competitors	• Location as competitive advantage • Industry size	• Location of my company • Forest certificatio n adoption	• Forest certification adoption • Lean manufacture adoption

Pre-testing

Prior to survey administration in each country, the survey was pre-tested among a total of five individuals selected from industry and academia in both of the respective regions where the survey was administered. The five US pre-tests were conducted in English, and five European pre-tests were conducted in either English or German (depending on the preference of the person

pre-testing the survey). The aim of pre-testing the survey was to reduce measurement error from poor questions or question wording by obtaining feedback regarding the relevance of each of the items to the hardwood veneer industry and the understandability of each of the survey questions. Changes were only made to the survey based on pre-tester recommendations when the changes did not conflict with the intent of the survey. For example, some of the pre-testers suggested that the survey contained too many items (i.e., was too long and would take too much time to complete). However, including fewer questions would have had a dramatic negative impact on model development from the survey results, so this suggestion was not incorporated in the survey development process.

Survey Administration

The survey was administered as an online questionnaire delivered to the respondents via e-mail. Coverage of the population was not deemed to be reduced by use of e-mail and Internet due to the international nature of the hardwood veneer industry (i.e., the commonality of receiving contacts from people and organizations via e-mail) and the prevalent use of e-mail and Internet to conduct business in each of the countries included in the survey. In addition, use of an online survey was considered to reduce non-response bias due to reduced costs of participating (i.e., quicker to respond online than in writing and use of a link within the e-mail that directed respondents to the survey instrument).

Each contact on the list of hardwood veneer company representatives received a personalized pre-survey e-mail on Monday morning that described the purpose of the study and encouraged the contacts to aid the researchers, their firms and the entire hardwood veneer industry by responding. One week later, each contact received a personalized e-mail invitation to respond to the survey. This e-mail contained additional information regarding the importance of the study, a link to the survey instrument with a unique access code for entering the survey, information regarding respondent confidentiality, and contact information of the researchers and human subjects' personnel should they have questions. Access codes were used to track the responses from contacts and to determine if they should receive a thank you e-mail/phone call or a reminder e-mail/phone call one week later. Respondents that indicated their interest in responding to the survey were reminded until they submitted an access code with a valid survey. Contacts were made with US companies in English and with Austrian/German companies in

German. However, Austrian and German companies were sent links to survey instruments in both English and German to accommodate for their language preferences. In order to increase participation (and reduce nonresponse bias), a drawing for two different awards was conducted following survey administration.

Data Handling

Data from US respondents was compiled separately from the Austrian and German data. The Austrian and German data were combined for analysis. All data (from Austria, Germany and the United States) were also combined for certain analyses. No access codes or other company identifiers were included with the data to be analyzed to maintain the anonymity of the respondents. Survey data were downloaded into Microsoft Excel for analysis. A hard copy of this data was retained in the event that the electronic versions were lost or destroyed.

Data Analysis

Following survey administration, the data were compiled and analyzed using Microsoft Excel and SAS. Basic statistical analyses were conducted with this data, including counts and percentages. A description of the statistical analyses conducted and the results can be found in the Results section of this document for each proposition. For some questions (primarily demographic questions), survey items were combined to make more sense in terms of reporting. Data analysis was conducted on Austrian/German data, US data, and combined data.

Results

Sampling Error

A census survey was attempted for the sample frame. Table 14 shows the sample frame, which is the number of companies who had a viable e-mail address and were contacted for this research. The survey sample includes those companies whose business activity involves the manufacturing or trading of decorative hardwood veneer. The response rate indicates the number of surveys completed by companies within the sample frame, while the adjusted response rate indicates the number of surveys completed by companies within the survey sample. There are firms included in the survey sample who went out of business during the course of this research project.

Table 14. Survey response rate results

Country	Sample frame	Survey sample	Completed surveys	Response Rate	Adjusted Response Rate
United States	36	35	30	83%	86%
Austria	20	14	6	30%	43%
Germany	61	51	24	39%	47%
Total	**117**	**100**	**60**	**51%**	**60%**

We can see from these results that we achieved the expected adjusted response rates overall and for each country. From this we can conclude that we have a very small amount of sampling bias in the data, and therefore the results can be considered an adequate representation of the population of hardwood veneer companies in these countries.

Given the small size of the population of hardwood veneer companies and the high survey response rates in each region, a finite population correction factor was used to adjust the standard errors of our analyses. The finite population correction factor may be applied when the sample size n divided by the population size N is greater than 0.05 (i.e., n/N>0.05). This reduces the standard errors and widens the confidence interval to lead to more statistically significant results. The finite population correction factor helps to incorporate any data that are a greater number of standard deviations from the sample mean and will be calculated as follows:

$$\sqrt{\frac{N-n}{N-1}}$$

The finite population correction factor was multiplied by the standard error in calculations of the data distribution reported in this study. This includes data from survey items with Likert scale categorical responses. The finite population correction factor will adjust the p-values for more statistically significant results. The value for the combined regions is shown in Table 15.

Table 15. Finite population correction factor for the survey

	Combined regions
n	60
N	117
Correction factor	***0.701***

Non-response Error

Bias can arise in survey results when the characteristics of the group of respondents differ from the characteristics of those who don't respond. Non-respondent bias was tested in two ways:

1) An analysis of the reasons given for not responding to the survey instrument was undertaken, and
2) A comparison of the company characteristics (i.e., company type and company size) of the non-respondents with the respondents was completed.

In order to determine the survey sample, companies in the sample frame were sent a pre-survey e-mail indicating that they were selected to participate in the survey, the purpose of the survey, and contact information of the researchers. Several company representatives responded after receiving the pre-survey e-mail to indicate that their company did not manufacture or trade hardwood decorative veneer. These companies were omitted from further survey correspondence. After the pre-survey e-mail, companies were sent a survey e-mail, and a follow-up reminder via e-mail to encourage responses. Non-respondents were contacted via telephone after that to remind them of the importance of the survey and to determine if the contacts had any questions. Some companies indicated during the phone calls that they did not want to respond, so they were asked at that time to give a reason for not responding. The reasons for not responding to the survey instrument can be found in Table 16.

Table 16. Reasons given by company representatives for not responding to the questionnaire

Reason for non-response	Frequency (Percent)			
	US	**Austria**	**Germany**	**Total**
No time to take surveys	1 (25%)	2 (25%)	1 (4%)	4 (10%)
Not interested in this survey	0 (0%)	2 (25%)	9 (33%)	11 (28%)
Responding to surveys is against company policy	0 (0%)	1 (13%)	1 (4%)	2 (5%)
Contact did not know me/want to answer over the phone	0 (0%)	0 (0%)	1 (4%)	1 (3%)
Company went out of business/was taken over	0 (0%)	0 (0%)	2 (7%)	2 (5%)
Contact was not able to be reached for comment	3 (75%)	3 (37%)	13 (48%)	19 (49%)
Total	**4 (10%)**	**8 (21%)**	**27 (69%)**	**39 (100%)**

The characteristics of the companies that did not respond are listed in Table 17. Some of this information was gathered during follow-up phone calls, and for the companies not willing to take the time to respond, the information was gathered from industry trade databases and company websites. Company representatives who did provide this information via telephone were asked to provide it in the same format as the respondents to the survey (as described in "Characteristics of survey respondents" section).

Table 17. Company characteristics of non-respondents

Characteristic	US companies	Austrian/German companies	Combined	Percent of non-respondents
Company type				
1) Veneer trader	1	20	21	54%
2) Custom slicer	0	1	1	2.5%
3) Veneer manufacturer	3	5	8	20.5%
4) Unknown	0	9	9	23%
Total	**4**	**35**	**39**	**100%**
Company size				
1) < 50	1	23	24	62%
2) 50-100	2	7	9	23%
3) 101-200	0	0	0	0%
4) >200	1	2	3	7.5%
5) Unknown	0	3	3	7.5%
Total	**4**	**35**	**39**	**100%**

These results indicate that the non-respondents were biased toward small trading companies. However, when extrapolating the results to veneer manufacturers, custom slicers, and larger firms, our conclusions would be more accurate.

Characteristics of Survey Respondents

The company representatives were asked to select among 6 different types of companies that best described their company's activities. These were combined into three main categories of companies that seemed to be a better representation of this demographic of the industry. The 'veneer trader' category includes both companies and agents that trade veneer. The "custom slicer" category includes companies whose primary business is based on custom cutting veneer for trading companies, agents and other veneer manufacturers. All of the other various types of veneer manufacturers were combined into the 'veneer manufacturer' category. The company

type categories and survey results can be found in Table 18. The adjusted response rate for this question was 100%. In addition, companies were asked to identify the size of their firm on a scale, as shown in Table 18. The adjusted response rate for this question was 99%.

Table 18. Company characteristics of survey respondents

Characteristic	US companies	Austrian/German companies	Combined	Percent of respondents
Company type				
1) Veneer trader	6	16	22	37%
2) Custom slicer	9	9	18	30%
3) Veneer manufacturer	15	5	20	33%
Total	**30**	**30**	**60**	**100%**
Company size				
1) < 50	13	27	40	67%
2) 50-100	3	0	3	5%
3) 101-200	7	2	9	15%
4) >200	6	1	7	12%
Total	**29**	**30**	**59**	**99%**

An attempt was made to obtain completed surveys from the company's top management. Table 19 shows the job title of the survey respondents. Seventy-five percent of the survey respondents were employed in a management role within the company, and about half of all respondents were the top management (CEO or President). The adjusted response rate for this question was 93%.

Table 19. Survey respondent job title

Job Title	United States	Austria/Germany	Combined	Percent of total respondents
CEO/President	11	18	29	48%
Sales Manager	11	2	13	22%
Other Manager	2	1	3	5%
Other	6	5	11	18%
Total	**30**	**26**	**56**	**93%**

A majority of the survey responses were received from top management of companies. Surveys received from company representatives not in top management were also included in the data analysis.

Testing the Propositions

Survey responses were analyzed to test the propositions generated from case study interviews from the previous study. Each of the propositions is addressed in turn.

P1) Younger hardwood veneer companies believe they are more innovative than older firms.

Company respondents were asked to denote the age range within which their company could be found. The age ranges above 50 years were condensed from the initial survey question to data reporting, and can be seen in Table 20. The adjusted response rate for this question was 100%.

Table 20. Company age survey question results

Company age	US companies	Austrian/German companies	Combined	Percent of respondents
0 – 9 years	2	2	4	7%
10 – 29 years	7	12	19	32%
30 – 49 years	12	9	21	35%
50 or more years	9	7	16	26%
Total	**30**	**30**	**60**	**100%**

In order to assess the belief of firm innovativeness, survey respondents were asked how strongly they agreed or disagreed with the statement: 'My firm is innovative.' Results for this question can be seen in Figure 13. Sixty-five percent of all respondents indicated that they agreed or strongly agreed that their firm is innovative. Of the total number of respondents from each region, 70% of US respondents and 60% of Austrian and German respondents believe their firms are innovative. The adjusted response rate for this question was 100%.

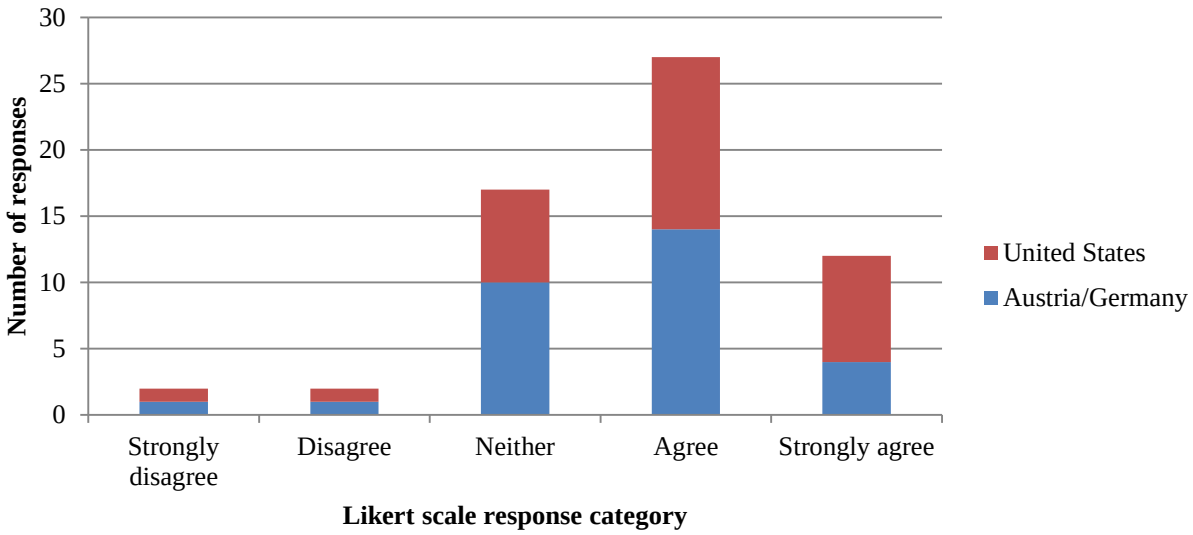


Figure 13. Total number of survey respondents who agree with the statement "My company is innovative"

Subsequently, data were analyzed to determine the respondents from each company age group who believe their company is innovative. The results in Table 21 indicate that a greater percentage of respondents from younger firms believe their companies are innovative than those of older firms. As a result, P1 is accepted based on these findings. However, the percent of respondents who indicated that their companies have innovated in 3 or more innovation areas as well as 4 or more innovation areas are also presented in Table 21. The routinized technological regime theory states that established companies in a mature industry situation will exhibit more innovation than new ventures (Winter, 1984). This result was assumed in this research. However, it was also assumed that firms would exhibit social desirability bias, where respondents will aim to 'please the researcher' by responding to questions based on the way they believe the researcher wants them to respond. The results in Table 21 clearly indicate that a greater percentage of older firms have actually innovated in multiple areas of innovation, yet a higher proportion of younger firms believe they are innovative. Interestingly, the data from this question coincides with the survey respondents' job title, where the uppermost management respondents indicated they were more innovative than lower managers responding to the survey. This trend could indicate that greater tenure of the respondent with the company may also lead to social desirability bias.

Table 21. Percentage of companies by age group who believe they are innovative, have innovated in 3 or more innovation areas and have innovated in 4 or more innovation areas

Company age	Percent of respondents who		
	Believe their company is innovative	**Have innovated in 3 or more areas**	**Have innovated in 4 or more areas**
0 – 9 years	75.0%	28.6%	0%
10 – 29 years	68.4%	50.0%	12.5%
30 – 49 years	66.7%	52.4%	19.0%
50 or more years	56.3%	50.0%	25%
Total	**65.0%**	**48.3%**	**16.7%**

P2) Hardwood veneer companies make deliberate attempts to innovate.

The deliberateness of a company's innovation was measured on a 5-point Likert scale indicating how strongly the respondent agreed with the statement that their firm made it a goal to innovate in each of the five areas of innovation. As Mintzberg and Waters (1985) pointed out, the extremes of the continuum from deliberate to emergent innovation attempts are nearly impossible to attain. Therefore, 'deliberate' and 'emergent' in this question refer to 'more deliberate than emergent' and 'more emergent than deliberate'.

The survey results are graphed in Figure 14 and reported as a percentage of all respondents in Table 22. Innovation attempts of companies were notably more deliberate than emergent. Overall, 67% of respondents indicated that their company made it a goal to innovate. As a percent of the total number of respondents from each region, 74% of US respondents and 57% of Austrian and German respondents believe that their companies make more deliberate attempts overall to innovate. The response rate for this question was 96%. Given these results, it can be concluded that companies in both regions make more deliberate attempts to innovate and P2 is accepted.

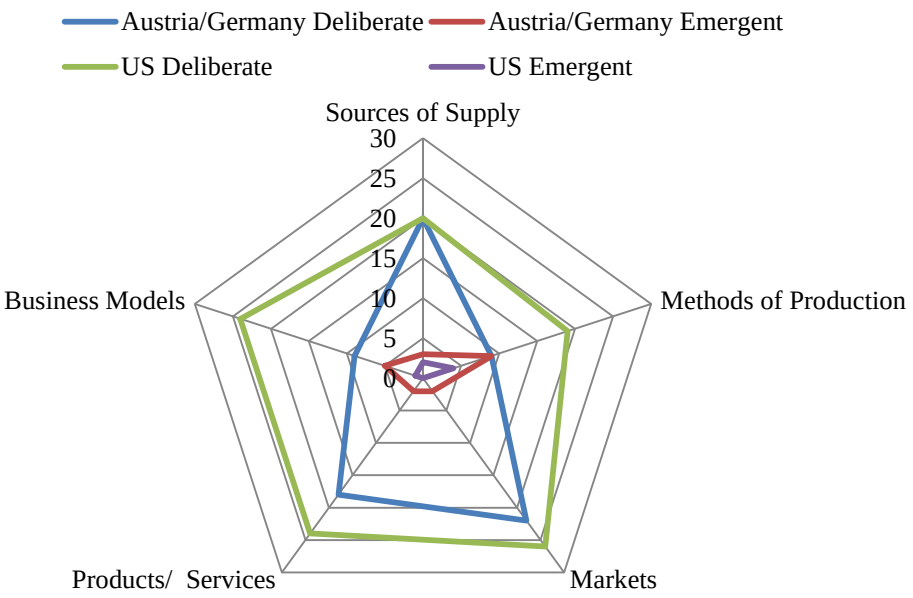


Figure 14. Number of companies in Austria/Germany and the United States who describe their firms' innovation tendencies as deliberate or emergent

Table 22. Percentage of companies in Austria/Germany and the United States who describe their firms' innovation tendencies as deliberate or emergent

Innovation Area	United States		Austria/Germany		t-statistic	p-value
	Deliberate	Emergent	Deliberate	Emergent		
Sources of Supply	62%	38%	69%	31%	0.670	0.6325
Production Methods	64%	36%	36%	64%	2.105	0.0908
Markets	86%	14%	77%	23%	1.507	0.2560
Products/ Services	79%	21%	66%	34%	1.356	0.3164
Business Models	79%	21%	33%	67%	3.925	0.0008
Total	**74%**	**26%**	**57%**	**43%**		

P3) Companies do not innovate in each of the five areas of innovation.

In order to test whether or not companies concentrated their innovation efforts on particular innovation areas or attempted to innovate in each of the five areas simultaneously, respondents were asked to indicate which of the five innovation areas their firm had largely accomplished innovating. Responses to this question can be seen in Figure 15. Eleven percent of all respondents indicated that their companies had innovated in all five innovation areas. All of

those companies were US firms. Most of the US and Austrian/German respondents indicated their company had innovated in 3 innovation areas or less. Albeit small, the percentage of companies who have innovated in each area of innovation negates the proposition. Companies can and do innovate in all five innovation areas, and P2 indicates that firms do make deliberate attempts to innovate. However, focusing efforts on all five innovation areas simultaneously is not a prevailing trend among all hardwood veneer companies.

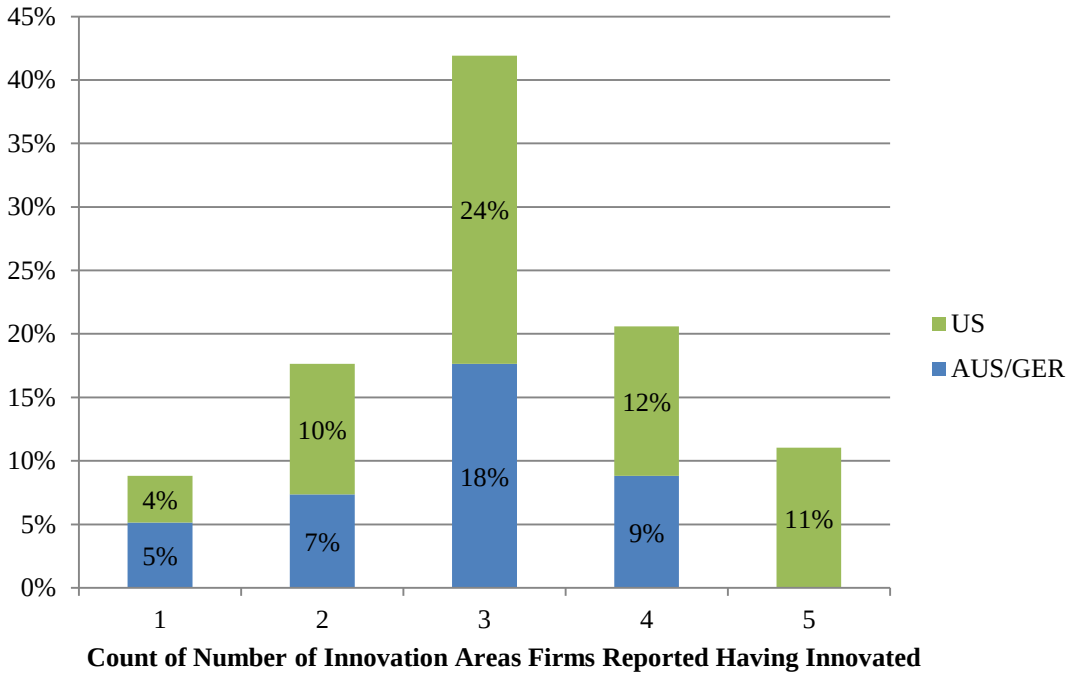


Figure 15. Percent of companies in each region who have largely accomplished innovation in a particular number of innovation areas

P4) Business model innovations are the most prevalent type of innovation.

The question asked of survey respondents to determine the innovation type most prevalent among hardwood veneer companies was the same for P4 as P3. Figure 16 shows the percentages of innovations in each innovation area by country. Results from this question reported as percentages of innovations by all companies participating in the survey are shown in Table 23. Of the innovation areas survey respondents indicated their companies had largely accomplished, market innovations were most prevalent (81%) among all respondents. In the United States, business models were the most prevalent at 80%, while in Austria and Germany, source of

supply innovations were most prevalent (50%). P4 is true of companies in the United States, but not in Austria and Germany and not across both regions in the survey.

Table 23. Percentage of largely accomplished innovations by innovation area across all respondents

Sources of Supply	Production Methods	Markets	Products/ Services	Business Models
58.8%	26.4%	81.1%	62.3%	28.3%

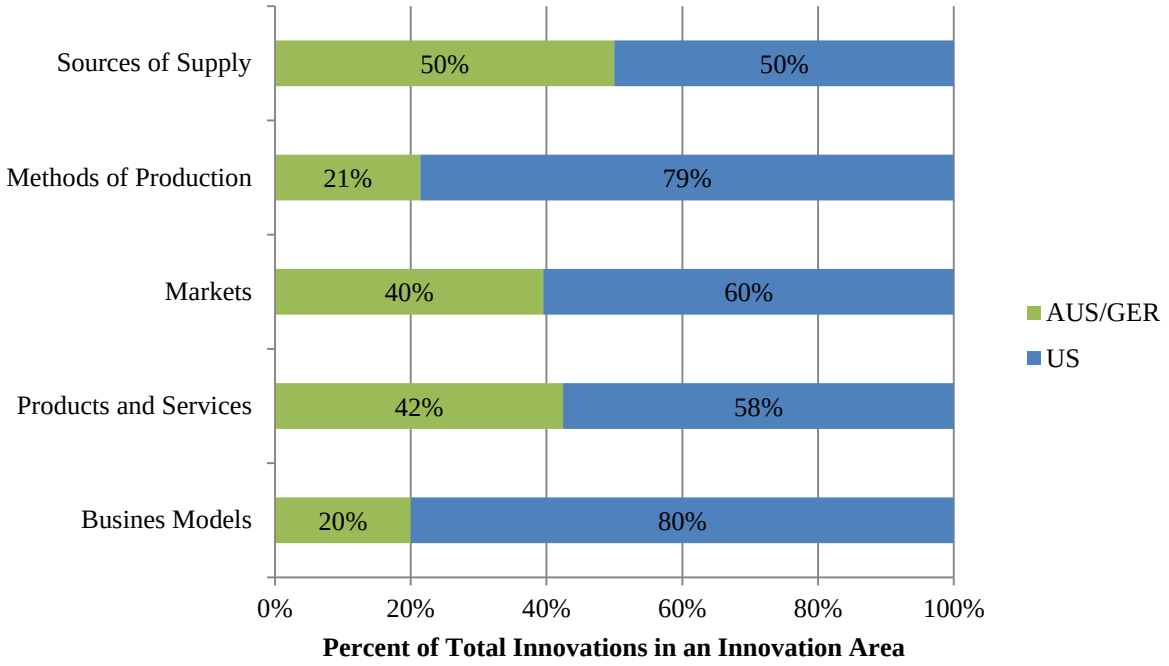


Figure 16. Comparison of percentage of self-reported, largely accomplished innovations by innovation area for firms in the US and Austria/Germany

P5) Companies use existing resources in existing markets.

Survey respondents were asked to self-report the category that best describes the innovation strategy their company uses. Innovation strategies range on two continuums of the companies use of existing or new resources and capabilities to serve existing or new customers. The categories and results are listed in Table 24. Thirty-eight percent of the survey respondents to this question (i.e., adjusted response rate of 98%) indicated that their companies use a regular strategy where existing resources and capabilities are leveraged to serve existing customers and markets. Most US and Austrian/German respondents chose this innovation strategy as prevalent

in their firms, which confirms P5 to be true of most hardwood veneer companies. However, there were also large numbers of US respondents indicating that their companies implemented a revolutionary strategy where new resources and capabilities were used to create new customers or markets and Austrian/German respondents who indicated that their companies implemented a resource-building strategy where new resources and capabilities were leveraged to serve existing customers and markets. This indicates that respondents perceived their companies to be using the innovations they created in their company strategies.

Table 24. Innovation strategies self-reported by survey respondents

Innovation strategy	Number of companies			Percent of respondents
	US	Austrian/German	Combined	
Regular: Uses existing resources to serve existing customers/markets	11	12	23	38%
Resource-building: Uses new resources to serve existing customers/markets	6	9	15	25%
Position-building or Niche: Uses existing resources to serve new customers/markets	5	5	10	17%
Revolutionary: Uses new resources to serve new customers/markets	8	3	11	18%
Total	**30**	**29**	**59**	**98%**

P6) Innovation strategies of companies are impacted most by economic environmental factors.

The impacts listed in Table 13 were tested in this research using 50 items with 5-point Likert scale response categories (i.e., higher response categories indicate stronger agreement with the survey item). Data for responses from negatively worded survey items were reversed prior to data analysis, so that all data were analyzed from positively worded survey items. The mean values of each item were compared between the US and Austrian/German companies and the strength of the relationships between these means values were tested for effect size using Cohen's d. Results are reported by environmental factor in Table 25 through Table 29. For a given survey item, if the effect size is 0.2 the effect is small, 0.5 the effect is medium, and 0.8 the effect is large (denoted in bold). The results indicate the magnitude of difference between the

means of survey responses from US and Austrian/German respondents for each of the survey items. These results indicate that a majority of the survey items had a different effect on the firms of respondents from the US to Austria/Germany.

Table 25. Social environmental effect size on innovation area survey ratings from Austria/Germany and United States firms

Social Factor Impacts to Innovation Area Survey Items	*Means*		*Cohen's d*
	US	*Aus/ Ger*	
Sources of Supply			
Language is a barrier in raw material procurement negotiations	4.03	3.55	**4.1**
Consumer expectations for raw material quality are high	1.70	2.48	**-6.0**
Production Methods			
The need for a safer working environment has caused my firm to improve its methods of production	3.20	3.11	**0.8**
Demographic changes in the workforce have improved my firm's production methods	3.07	3.15	**-0.8**
Markets			
Regional consumer product preferences do not allow my firm to enter new markets	3.17	3.41	**-2.0**
Cultural differences are a barrier for my firm's identification of or entrance into new markets	3.31	3.58	**-2.0**
Products/Services			
Consumers demands for product quality make it difficult for my firm to develop and offer new products or services	2.90	3.14	**-1.9**
Changing demographics in various parts of the world have improved my firm's ability to develop new products or services	3.13	2.89	**2.2**
Business Models			
Ensuring worker safety enhances my firm's ability to generate value	3.27	2.88	**4.5**
Adaptation to changes in consumer demand has created an opportunity for my firm to reorganize in a way that generates value	3.37	2.88	**4.8**

Table 26. Technological environmental impacts to innovation area survey ratings from Austria/Germany and United States firms

Technological Factor Impacts to Innovation Area Survey Items	*Means*		*Cohen's d*
	US	*Aus/ Ger*	
Sources of Supply			
Advances in supply chain technology have not improved my firm's ability to identify and track new sources of supply	2.60	2.96	**-1.1**
Advances in veneer slicing technology have increased the range of log qualities my firm can purchase and produce	2.73	2.86	**-5.0**
Production Methods			
Current open source slicing technology does not meet my firm's production needs	3.37	3.60	**-2.4**
Current open source supply chain technology meets my firm's needs	3.37	3.00	**4.0**
Markets			
Supply chain technology has helped my firm identify or enter new markets	3.30	2.59	0.2
Technological advances outside the veneer industry have improved my firm's ability to find or enter new markets	2.79	2.77	**6.8**
Products/Services			
New technologies have improved my firm's capability to develop and offer new products or services	3.13	2.96	**1.5**
Advancements to supply chain technology have not aided my firm's efforts to develop and offer new products or services	2.79	2.77	0.2
Business Models			
Creation or adoption of new technologies has completely changed how my firm operates	3.10	3.00	**0.8**
Supply chain technology has improved the way my firm is organized in a way that is competitive	3.00	2.85	**1.7**

Table 27. Ecological environmental impacts to innovation area survey ratings from Austria/Germany and United States firms

Ecological Factor Impacts to Innovation Area Survey Items	*Means*		*Cohen's d*
	US	*Aus/ Ger*	
Sources of Supply			
Certified raw materials are easy to find	2.57	2.45	**1.0**
All of the raw materials my firm needs to serve our customers are readily available	2.20	3.48	**-9.9**
Production Methods			
Changes in products or markets to meet consumer demand have altered the production methods needed by my firm	3.43	3.58	**-1.2**
Close proximity to competitor firms that supports knowledge transfer has improved my firm's production methods	3.17	2.77	**3.9**
Markets			
The location of my firm's facilities no longer provides a competitive advantage for finding or entering new markets	3.45	2.88	**4.9**
The small size of the US veneer industry does not improve my firm's ability to find or enter new markets	3.11	2.92	**1.6**
Products/Services			
My firm's location does not facilitate new product or service development	3.33	2.71	**5.4**
Adoption of forest certification is a barrier to my firm's efforts to develop and offer new products or services	3.00	2.74	**1.7**
Business Models			
The implementation of forest certification has created a need to reorganize my firm in a way that creates value	3.13	2.63	**3.7**
The implementation of lean manufacturing has created an opportunity for my firm to create value through reorganization	3.33	2.81	**5.0**

Table 28. Economic environmental impacts to innovation area survey ratings from Austria/Germany and United States firms

Economic Factor Impacts to Innovation Area Survey Items	*Means*		*Cohen's d*
	US	*Aus/ Ger*	
Sources of Supply			
Exchange rate changes often force my firm to alter where raw materials are sourced	3.14	3.39	**-1.8**
Domestic raw material supplies are affordable for my firm	2.70	3.32	**-5.0**
Production Methods			
Lack of availability of capital has negatively impacted my firm's ability to improve its production methods	3.31	3.44	**-1.0**
Collaborations with educational institutions have improved my firm's production methods	2.77	2.73	0.3
Markets			
The global economic crisis has had a negative impact on my firm's ability to find or enter new markets	2.13	3.25	**3.9**
Currency exchange rates negatively impact my firm's entrance into new markets	3.03	3.08	-0.4
Products/Services			
Cheaper, imported products on the market create an opportunity for my firm to develop and offer new products or services	2.17	2.75	**-4.5**
The current economic crisis has created opportunities to develop or offer new products or services	2.73	2.72	0.1
Business Models			
The global economic crisis has not allowed my firm to reorganize in a way that is competitive	3.07	3.18	**-0.8**
Labor costs are a barrier to my firm's efforts to reorganize in a way that creates value	2.57	2.70	**-1.1**

Table 29. Political environmental impacts to innovation area survey ratings from Austria/Germany and United States firms

Political Factor Impacts to Innovation Area Survey Items	*Means*		*Cohen's d*
	US	*Aus/ Ger*	
Sources of Supply			
Export trade policies have aided domestic sourcing of raw materials	2.30	2.93	**-5.4**
The Lacey Act has created a trade barrier for my firm	3.30	3.37	-0.6
Production Methods			
Regulatory changes that tighten product standards are a barrier	2.93	2.70	**1.9**
Federal tax policies are a barrier for my firm to improve its production methods	3.07	2.79	**2.6**
Markets			
International marketing efforts of trade associations have aided new market development for my firm	3.00	2.36	**5.8**
Current government policies aid my firm's efforts in finding or entering new markets	2.54	2.27	**2.3**
Products/Services			
Current legislation regulating product sustainability is a barrier to development and offering of new products or services	2.83	2.96	**-1.0**
Federal tax policies do not support my firm's efforts to develop and offer new products or services	2.63	2.63	0.0
Business Models			
Legal restrictions on lending have not allowed my firm to reorganize in a way that creates value	3.23	3.19	0.4
Current regulations improve my firm's ability to create a competitive advantage in the global marketplace	2.53	2.54	-0.1

In addition, the overall effect sizes of each of the environmental areas on each innovation area were calculated as a difference from the average response (i.e., Likert scale value of 3, squared sample standard deviation of 1 and number of survey responses as 30) and reported in Table 30. The effect sizes greater than 0.8 are highlighted in bold text, and the largest effect size for each region (i.e., US, Austria/Germany, and combined) are highlighted in bold red text. The environmental factors with the greatest impact on innovation across all companies were political factors. From these results, P6 must be rejected because the economic environmental factors

were not the greatest impacts to innovation strategies of all companies. However, economic factors most greatly impacted innovation for US companies.

Table 30. Combined means of environmental impact factors across all innovation areas and effect size of relationship between those means

Environmental factor	Mean responses			Cohen's d		
	US	Aus/Ger	Combined	US	Aus/Ger	Combined
Political	2.87	2.37	2.51	**-3.1**	**-4.1**	**-6.4**
Economic	2.54	2.42	2.48	**-3.7**	**-3.9**	**-5.2**
Social	2.92	2.13	2.53	-0.7	**-6.0**	**-4.5**
Technological	2.83	3.44	3.14	**-1.4**	**1.0**	**1.3**
Ecological	2.87	2.67	2.77	**-1.2**	**-1.9**	**-2.2**

P7) Environmental factors have the greatest impact on innovation of hardwood veneer markets.

In a similar fashion to the analysis conducted for P6, survey items were sorted into groups based on the innovation area being impacted and means were reported in Table 31. These results indicate that product and service innovations were most greatly impacted by the environment across all companies surveyed. In the United States, companies reported greater impacts to source of supply innovations, while Austrian/German companies experienced the greatest environmental impacts to business model innovations. These results indicate that markets were not the innovation area most greatly impacted by environmental factors, so it is clear that P7 must also be rejected.

Table 31. Combined means of all environmental impacts on each innovation area and effect size of relationship between those means

Innovation area	Mean responses			Cohen's d		
	US	Aus/Ger	Combined	US	Aus/Ger	Combined
Sources of Supply	2.73	3.08	2.90	**-3.1**	**0.9**	**-1.5**
Methods of Production	3.17	3.08	3.13	**1.9**	**0.9**	**1.9**
Markets	2.98	2.88	2.93	-0.2	**-1.3**	**-0.9**
Products and Services	2.87	2.85	2.86	**-1.5**	**-1.6**	**-2.0**
Business Models	3.07	2.84	2.95	**0.8**	**-1.8**	-0.6

Discussion/Conclusions

The Survey Instrument

The overall adjusted response rate for this survey of US, Austrian, and German companies was 60%, which is comparable to surveys administered to other wood products industry sectors. The response rate in the United States was larger than either Germany or Austria, primarily due to the relationship the researcher has established with this industry population. During telephone inquiries, German and Austrian companies had a greater tendency to decline participation in the research because of unfamiliarity with the researcher or university and were uncomfortable divulging information to someone with which they had no relationship. However, the high response rate led to the use of an assumption of the data being an adequate enough representation of the population to use a finite population correction factor to encourage more statistically significant results.

The intent of the survey instrument was to obtain responses from the top management of companies in the hardwood veneer industry regarding their innovation strategies and the impacts to them from external environmental factors. The response rate for respondents with management job titles was quite high (75%). This intention was considered fulfilled.

The hypotheses were tested using statistical methods that assume non-normality. This is due to the nature of the responses as categorical variables from 5-point Likert scale items. The F-statistics provided indicate that the means of the data from US and Austrian/German respondents were statistically different, allowing for comparisons that make sense.

Innovation Strategies in use in the Hardwood Veneer Industry

McClelland (1953) theorized that in order for individuals to be motivated, certain needs should be met. Some people have a high need for power, and will be more motivated if the task outcome results in an increase in their level of power. Some people have a high need for affiliation, in which their motivation stems from their perceived level of belonging to a group and the feeling of collaboration achieved from participating. Other people have a high need for achievement, where their motivation stems from the use of knowledge and skills to set and achieve challenging goals. One characteristic of high need for achievement individuals is that

they do not typically take part in extreme risk-taking challenges (i.e., challenges that are too easy or too difficult than they perceive can be achieved). If we were to apply this theory to firms in the hardwood veneer industry, company management would exhibit a moderate level of belief that a goal could be achieved in order for them to be motivated to take on the challenge.

The results of the survey conducted as a part of this research indicated that top management of hardwood veneer companies in both US and Austrian/German companies believed their firms were innovative by percentages of 70% and 60%, respectively. In addition, top management in 67% of the responding companies reported that their companies also made deliberate attempts to innovate. Eleven percent of all respondents from companies in these regions even reported their companies as having innovated in all five areas of innovation, with a majority of the companies having innovated in 3 areas. The predominant type of innovation across regions was market innovations, but the focus shifted slightly to other innovation areas when looking at the regions separately. In addition, 38% of all companies had an innovation strategy that employed their existing resources and capabilities in order to satisfy current customers and markets' needs, known as a regular innovation strategy.

It is important to understand the innovation strategy being employed by an industry in order for improvements to occur. There are two important characteristics of the regular innovation strategy that are keys to understanding a company's competitiveness. The first characteristic is that any new products created using this innovation strategy may take some market share from existing products, but do not render them obsolete. And the second characteristic is that the company's position in relation to other firms in the industry (deemed 'coopetitors' by Afuah (2009)) does not cause them to become uncompetitive. In order for these companies to change their positions in the marketplace in relation to competitors and competing products is to create distinctive resources/capabilities that will generate unique value to the firm, or to find a way to improve their position in relation to competitors. One method for identifying such opportunities is by understanding the macro-environmental factors that impact their industry, which may differ from region to region.

Comparison of Results from US and Austria/Germany

Differences exist among the innovation approaches of survey respondents' companies in Austria/Germany and the United States. Overall, it has been noted that companies in both

regions make more deliberate than emergent attempts to innovate. However, on average, 75% of the innovations by US companies were more deliberate than emergent, while only 52% of Austrian/German companies' innovations were more deliberate than emergent. Austrian/German companies' innovation attempts were more deliberate than emergent in all innovation areas except production methods. US companies seem to be making a more conscious effort to innovate in all areas of innovation, while Austrian/German companies are taking a more reactive approach to innovation. This coincides with the data collected during case study interviews in a previous phase of this research, in which Austrian/German companies had more emergent than deliberate innovation strategies in both production method and market innovation areas. The period of time when the interviews were conducted in Austria (2009), in the US (2010) and the survey administerd (2011), could be one explanation for these results. The firms in Austria and Germany are likely experiencing a lag in the effects of the economic crisis on their firms, and are thus not making as many deliberate attempts to innovate yet.

The more deliberate innovation strategy approach seems to be paying off for US companies, as all of the 11% of survey respondents whose companies had innovated in all five innovation areas were from the US. Only 27% of Austrian/German companies had innovated in 3 or more areas, while almost half (47%) of US companies had achieved the same feat. From the data collected in this research, it is not possible to determine the cause of this trend. The lack of focus on trying to innovate is suspect. However, regional differences in environmental impacts to innovation may also be a driver of this trend.

The type of innovation largely accomplished by firms differed in prevalence from region to region. US companies tended to focus on production method and business model innovations, while Austrian/German companies tended to focus more on source of supply and product and service innovations. This differs from the case study results, where business model innovations prevailed across companies, followed by production method and market innovations. It is possible that the case study results were inadvertently biased in this regard based on the small sample of companies interviewed.

The most prevalent innovation strategy employed by companies was a regular innovation strategy, with 38% of companies employing this strategy overall. However, the second most prevalent innovation strategy type differs from the US to Austria/Germany. Twenty-six percent

of US company representatives reported using a revolutionary innovation strategy, where new resources and capabilities are used to satisfy new customers or new markets. Thirty-one percent of Austrian/German company representatives reported using a resource-building innovation strategy, where new resources and capabilities are leveraged to suffice the needs of existing customers or markets. This result is congruent with the most prevalent type of innovation firms from each region largely accomplished. Markets are the most prevalent innovation area largely accomplished across all companies (81%), yet only 35% of the innovation strategies (i.e., revolutionary and position-building or niche innovation strategy types) involved new market creation. Market innovations were more commonly accomplished by US firms (60%) than Austrian/German firms (40%), likely due to the lack of environmental factors impacting market innovations in the US as compared to Austria/Germany. Forty-three percent of the innovation strategies (i.e., revolutionary and resource-building innovation strategy types) involve the creation of new capabilities and resources, which coincides with the innovation areas largely accomplished for the two regions (i.e., production method, source of supply and products and services). The innovation strategy employed by a company is also greatly influenced by the type of environment the company needs to react to.

Response to Environmental Impacts

The environmental factors that most impacted innovation in the hardwood veneer industry were political factors. From the survey, these include trade association efforts to create new markets, export trade policies impacts on raw material sourcing, federal tax policies preventing production method improvements, and government policies aiding new market identification or entrance. US companies experienced greater impacts from economic factors, including domestic sourcing of raw materials, global economic crisis inhibiting new market identification or entrance, and cheap imports creating opportunities for firms to develop new products and services. This trend shifted to social factors for Austrian/German companies, including high consumer expectations for raw material quality, value-generating reorganizations resulting from adaptations in consumer demand, organizational value-addition by ensuring worker safety and language barriers to raw material sourcing.

Given the fact that the hardwood veneer industry was still in the midst of an economic crisis during the administration of the survey instrument, it is interesting that economic factors were

not a more substantial impact factor. However, market innovations were the most common type of innovation firms had largely accomplished, and perhaps this was in response to the impact of the economic and social environmental factors previously mentioned.

The innovation areas most impacted overall by environmental factors were products and services. US companies experienced the greatest environmental impacts to sources of supply, but this trend changed to business models for Austrian/German companies. For US and Austrian/German companies, this result is directly in line with the least prevalent type of innovation area firms had largely accomplished (i.e., sources of supply and business models, respectively). These results do not correlate with the results from the previous case study examination of hardwood veneer companies in these regions, which identified markets as being most impacted by the environment for both regions. Interestingly, the case studies noted products and services in the US and production methods in Austria/Germany as the most innovated areas for companies in these regions. The US results indicate firms understand that products and services are in need of innovation and they have taken on the challenge. The Austrian case study results may not correlate with the survey results due to the inclusion of Germany in the survey.

The overall impacts to innovation strategies can be explained more clearly by looking at each region separately. US companies employ innovation strategies that focus on existing resources and markets or new resources and markets (i.e., regular and revolutionary strategies) because the greatest environmental impacts on their innovation come from economic factors. This might mean that firms are either very greatly impacted by economic factors and maintain use of existing resources to serve existing markets, or economic factors cause more positive impacts allowing them to utilize new resources to serve new markets. In addition, US firms exhibit a high level of deliberate innovation (75%), due to the fact that their most impacted innovation area is sources of supply. These firms are not experiencing great impacts to business model innovation, which can drive innovation in other areas of the firm. As a result, US firms have a relatively high percentage of companies who have largely accomplished innovation in three or more innovation areas.

In contrast, Austrian/German firms are employing innovation strategies that focus on existing markets (i.e., regular and resource-building strategies) because the greatest environmental

impacts on their innovation come from social factors. In addition, Austrian/German firms only make deliberate attempts to innovate 52% of the time because their business model innovation is most impacted by the environment. These companies could be having a difficult time organizing themselves in ways that are conducive to innovation in other areas, and thus have a lower level of innovations largely accomplished as a result (27%).

The preponderance of evidence from this survey suggests that firms in the hardwood veneer industry are innovative. However, firms in both regions should make a conscious effort to adopt more deliberate innovation activities that focus on mitigating the impacts from the major environmental factors as well as attempting innovation in areas most greatly impacted by the environment. Firms in both regions would do well to communicate with one another about their experiences innovating in their strength areas. A discussion about their most impacting environmental factors might bring about ideas that firms can use to collaboratively change their environmental situation. However, further analyses need to be conducted to understand why companies with similar innovation strategies are responding to environmental impacts the way they are. A model of this relationship would provide more conclusive evidence as to the relationship that truly exists between innovation strategies in use in the hardwood veneer industry and the impacts from environmental factors.

References

Abernathy, W.J. and K.B. Clark. (1985). Innovation: Mapping the winds of creative destruction. *Research Policy*. 14(1): 3-22.

Afuah, A. (2009). Strategic Innovation: New Games for Competitive Advantage. New York, NY: Routledge.

Aguilar, F.J. (1967). Scanning the Business Environment. New York, NY: Macmillan.

Dillman, D.A., Smyth, J.D., et al. (2009). Internet, Mail, and Mixed-mode Surveys : The Tailored Design Method. Hoboken, N.J., Wiley & Sons.

Eisenhardt, K.M. (1989). Building theories from case study research. Academy of Management Review. 14(4): 532-550.

McClelland, D.C. (1953). The Achievement Motive. East Norwalk, CT: Appleton-Century-Crofts.

Mintzberg, H. and Waters, J.A. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal* 6: 257-272.

Norwood, F.B. and J. L. Lusk. (2011). Social desirability bias in real, hypothetical and inferred valuation experiments. *American Journal of Agricultural Economics*. 93(2): 528-534.

Sauber, T. and H. Tschirky. (2006). Structured Creativity : Formulating an Innovation Strategy. Basingstoke [England] ; New York, Palgrave Macmillan in association with the European Institute for Technology and Innovation Management.

Smith, R.L., V.H. Cossio, and O. Parhizkar. (2009). Introducting lesser-known wood species from certified forests in Bolivia to the U.S. market. *Forest Products Journal*. 59(9): 38-44.

Quesada-Pineda, H. (2010). Innovation activities in the primary wood products sector: A case study. *Wood and Fiber Science*. 42(4): 511-522.

Schumpeter, J.A. (1939). Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process. New York, NY: McGraw-Hill Book Company, Inc.

Veneernet.com. (2010). Directory of Face Veneer Suppliers, Veneer, Sliced. Accessed October 2010 online at: http://www.veneernet.com.

Wiedenbeck, J., M. Wiemann, D. Alderman, J. Baumgras, and W. Luppold. (2004). Defining Hardwood Veneer Log Quality Attributes. Gen. Tech. Rep. NE-313. Newtown Square, PA: United States Department of Agriculture, Forest Service, Northeastern Research Station.

Winter, S.G. (1984). Schumpterian competition in alternative technological regimes. *Journal of Strategic Economic Behavior and Organization.* 5: 137-158.

Yin, R.K. (2009). Case Study Research: Design and Methods. Los Angeles, CA: Sage Publications.

Chapter 5: Modeling the Environmental Impacts to Innovation in the Hardwood Veneer Industry

Introduction

The hardwood veneer industry is comprised of a unique set of firms that have specialized in a particular market segment of the wood products industry. From the forest to the consumer, this wood industry segment provides important functions from wildlife habitat management, to a source of product differentiation for loggers, sawmills, and other wood traders, to a means of conserving the highest quality wood for the most benefit and enjoyment of consumers. As a niche industry segment, these firms have developed a distinct set of resources to meet the needs of a select set of consumers. The hardwood veneer industry is also a mature industry that faces an array of challenges to maintain relevancy in the face of substitute products and high global competition for a dwindling consumer base.

In order to create sustainable competitive advantages, firms need to find ways to innovate that create valuable, rare, imperfectly inimitable, and non-substitutable marketplace advantages (Barney, 1991). The combinations companies develop to use their capabilities and resources in unique ways to serve markets and customers are called innovation strategies. These innovation strategies can be affected by various environmental influences while they are being implemented.

The overall goal of this research is to gain insight about how innovation strategies are impacted by environmental factors at play on the hardwood veneer industry, and to help firms navigate through this environment by providing recommendations to improve their innovation strategies in a way that gains competitive advantage. Using previous research as support, a model of the impacts to innovation in the hardwood veneer industry is described and recommendations provided to help guide industry firms in developing more effective innovation strategies.

Literature Review

Innovation Areas and Innovation Strategies

Innovation is the beginning or creation of something new. Firms gain competitive advantages from innovating and changing to meet global market demands of consumers (Porter, 1990). Innovation can be focused in different areas of an enterprise. Schumpeter (1939) proposed five different areas of

innovation in the firm, namely sources of supply, methods of production, markets, products and services, and business models. Similarly, the Organization for Economic Co-operation and Development (OECD) (2005) suggests that four areas of innovation exist, and are product, process, marketing, and organizational. Boer and During (2001) hypothesized three areas, namely products or services, processes, and business systems. Schumpeter's (1939) areas of innovation were selected for use in this research due in part to the fact that they seem to be defined in the broadest terms of innovation in an enterprise and subsequent theories stem from them. Sources of supply, methods of production and markets exemplify the supply chain elements of a firm's organizational structure, or vertical scope of the firm. Products and services are offered by way of this supply chain structure and the business model is the overarching driver of firm strategy and performance in each area.

An innovation strategy further sets direction for innovation in these areas within the organization while ensuring consideration of other relevant information (i.e., barriers, degree of newness, etc.) (Sauber and Tschirky, 2006). The strategies firms use to innovate can be categorized by their use of resources and capabilities to serve markets and customers. Afuah (2009) proposed a theory of innovation strategies that describes firms based on their rendering of existing resources/capabilities or products obsolete. Abernathy and Clark (1985) proposed a similar set of innovation strategies which describe the use of technology as the impetus for the strategy. These two theories were combined for this study to create four innovation strategies that rely on existing or new resources and capabilities to serve existing or new markets and customers:

1) Regular: Existing resources/capabilities are used to serve existing markets or customers.

2) Resource-building: New resources/capabilities are used to serve existing markets or customers.

3) Niche: Existing resources/capabilities are used to serve new markets or customers.

4) Revolutionary: New resources/capabilities are used to serve new markets or customers.

In this research, survey respondents were asked to self-report their use of resources and capabilities to serve markets and customers as one of these four innovation strategy types. When using self-reported measures, there is often the concern that social desirability bias may impact the results. Social desirability bias (SDB) is a phenomenon which suggests that in order to behave in a way that survey respondents believe the researcher wants them to behave, survey respondents tend to bias their responses towards values they think are the most socially acceptable. SDB was of limited concern

when evaluating companies based on their self-reported innovation strategy types due to the realness of the study (as real money experiments tend to lead to results with less SDB than hypothetical experiments due to the perceived risk involved) (Norwood and Lusk, 2011).

Innovation Resources of Firms

Subsequent to understanding what types of strategies firms may utilize to innovate is the importance of understanding the resource inputs to innovation. In the resource-based view of the firm, valuable, rare, inimitable and non-substitutable resources are said to provide firms with sustained competitive advantage (i.e., a value-generating strategy that is not being duplicated and whose benefits cannot be duplicated by competitor firms) (Barney, 1991). Many types of resources could fit these criteria, depending on the industry. Some of the more prevalent resources were explored in this research, including international presence, geographic proximity to industry 'hotspots', patents, firm size, networking activities, and firm age. Innovation strategies of firms will engage unique combinations of these resources to serve markets and customers and gain competitive advantages over other industry firms.

International Presence

Firms exist for the purpose of making money. The basic laws of economics say that firms will produce goods in an attempt to gain from trading. As domestic market needs are met, firms should (and do) expand their operations internationally in order to suffice the needs of other markets not being met by the existing set of firms there. Porter (1990) argues that sustaining a competitive advantage involves having an international presence in order to capitalize on local advantages, gain economies of scale, and for local market learning.

Geographic Proximity to Industry Hotspots

The spread of globalization in the 20th century has not come without its consequences, however. The process of globalization has resulted in the detrimental evolution of resources into ubiquities that deprive firms of their once held competitive advantages (Maskell, 2001). Knowledge is power, as the saying goes, and also an innovation resource that is potentially a form of sustained competitive advantage firms can use to cope with the disadvantages of globalization (Maskell, 2001). 'Knowledge spillovers' (i.e., dispersal of new economic knowledge from entities different than those receiving it) are said to occur from colocation of firms similar or complementary to an industry within geographical agglomerations or 'clusters' (Audretsch and Feldman, 1996).

Geographical clustering is also a powerful strategic mechanism in the lifecycle of an industry. It is said that tacit knowledge is costlier to transmit the farther it is disseminated from the source (Audretsch and Feldman, 1996). Some knowledge transfer occurs from continuous interactions amongst competitors (Maskell, Bathelt, and Malmberg, 2006; Porter, 1990) as well as through the pool of workers in the geographic area that become specialized in the industry and move from company to company (Maskell and Malmberg, 1999; Porter, 1990). Through these interactions and worker shifts, firms become adept at quickly and easily reading the market signals of their competitors, customers and suppliers in terms of knowledge about production methods, products and services, and business models (Maskell and Malmberg, 1999).

Additionally, supply chain advantages, such as closer proximity to raw materials and customers, can be a cause of industry clustering. A majority of hardwood veneer industry firms clustered production facilities in Indiana (Indianapolis and New Albany), Kentucky (Louisville), and Ohio (Cincinnati) to reduce time and cost of transport of high quality forest resources (Callahan, 1990). A cluster of veneer sales firms developed and successively dwindled following the progression of the furniture industry's development and eventual departure from High Point, North Carolina (Callahan, 1990). However, it is said that 'ideas need space', so industries that clustered in the early industry lifecycle stages may tend to migrate away from clusters as they progress through the industry lifecycle (Audretsch and Feldman, 1996). In this study, the use of geographic proximity to clusters was used to provide insight regarding the response of firms within theoretical clusters to their environment.

Trade Show Attendance and Trade Association Membership

Innovation can be facilitated by boundary spanning, or tapping into cross-functional knowledge bases within an organization and in a similar fashion with individuals external to the organization from a diverse set of backgrounds. Forums for learning and networking with people from diverse knowledge bases are an inexpensive and relatively easy way for organizations to share information and develop innovative ideas without the burden of supporting a team of scientists to provide the research and development needs for the firm's innovation activities. The assembly of individuals at international trade shows and other periodic events, like trade association conferences and meetings, are thought of as 'temporary clusters' (Maskell, Bathelt, and Malmberg, 2006; Bathelt and Schuldt, 2008) that can act as a source of extemporaneous innovation due to their propensity to incite tacit knowledge trading (Rinallo and Golfetto, 2011).

Trade shows motivate attendance by not only market actors, but firms tangentially related to the industry holding the trade show (Rinallo and Golfetto, 2011). Interactions with all forms of industry partners are a critical element of knowledge transfer that would be difficult to duplicate outside the trade show environment. Information regarding products, market developments and planning can occur with current industry partners, in addition to identifying new partners to sell products to, source raw materials from or even innovate with (Maskell, Bathelt, and Malmberg, 2006). In this research, trade show attendance was asked of hardwood veneer firms and used with geographic proximity to clusters and firm type data to understand needs for knowledge transfer within theoretical clusters.

Membership and participation in trade associations provides an instant network of firms to tap into for knowledge transfer within an industry. Many trade associations collect data about their members and distribute it to dues-paying members or other organizations that pay for it, thus serving as mechanisms for information-exchange (Kirby, 1988). Trade association meetings provide a venue for competitors to compare strategies and market knowledge (Maskell, Bathelt and Malmberg, 2006). In this research, trade association membership was questioned of firms and used to understand the knowledge exchange that might be necessary for firms in each theoretical cluster.

Patents

The risks of geographical clustering and sharing ideas in trade show or trade association forums include transfer of proprietary tacit knowledge. The employees of an organization serve as intellectual assets that may transfer tacit knowledge if they gain employment with a competitor (often as a result of worker specialization in geographic clusters). During trade events, the sharing of proprietary tacit knowledge may be inadvertent. In order to protect an organization from other firms capitalizing on this kind of knowledge transfer, organizations may opt to implement the use of non-disclosure agreements or patents. Patents are a form of intellectual property protection that safeguards the transfer of invention knowledge from make, use, sale, importing into the United States or selling through the United States (USPTO, 2012).

The number of patents an organization has registered is an indication of not only their inventing ability, but also their intent to signal to the market that their knowledge and experience are moving in a certain direction. Firms in this research study were asked to indicate the number of patents their firm holds. These patents indicate a more deliberate innovation strategy is being employed and that an organization holds an innovation resource that can gain them a competitive advantage for 17 years (USPTO, 2012).

Firm Size

As an innovation resource, firm size has been debated in the research as to whether it should be considered a variable indicative of innovativeness. The potential for larger capital expenditures on research and development can give large firms an innovation resource advantage (Schumpeter, 1942; Cohen and Klepper, 1996). However, studies have concluded that larger firms may also lack ingenuity and agility in responding to market opportunities (Cohen and Klepper, 1996). In the forest products industry, Wagner and Hansen (2005) conducted research on firm size in relation to innovativeness and determined that firm size played a role in the type of innovations firms focused on to gain competitive advantage (i.e., large and medium firms focused on technological innovation, small firms focused on business model and product innovations).

In this research, two measures of firm size were used to determine the capacity of innovation resources available to firms within a cluster. The measures used were annual sales and number of employees. Using these values in relation to the type of firm, a clearer picture of the relative firm size and innovation potential could be gained of firms within defined clusters.

Firm Age

Firm age represents one facet of an historical, imperfectly imitable resource (Barney, 1991). Barney was referring to the strategic actions or resources firms can acquire and use at different points along their organizational timeline that can be used to achieve competitive advantages and are not imitable by competitor firms. Firm age is considered a measure of innovative activity in the lifecycle perspective of an industry, with younger firms exhibiting higher innovation rates during the early stages of the lifecycle and more established firms innovating at higher rates during lifecycle maturity (Audretsch and Feldman, 1996).

Firm age was considered in combination with type of firm when developing insights about innovation resources used among firms in individual clusters. Firm age could also help indicate competitive threats. For example, in a mature industry, it would make sense that the capital intensive manufacturing firms would be older. Younger manufacturing firms could have some other type of strategic advantage that threatens the competitive advantage of older manufacturing firms.

Innovation clusters formed based on the results of a survey of hardwood veneer manufacturers in Austria, Germany and the United States were characterized by their use of the aforementioned resources for innovation. These clusters were established based on the way in which environmental

factors impacted their innovation in each of the five innovation areas (i.e., sources of supply, production methods, markets, products and services, and business models). The environmental factors in question and the approach for analyzing them are described in further detail next.

Theories of Environmental Impacts to Innovation

The resource-based view of the firm concerns the internal aspects of the firm which are used to develop competitive advantages in the marketplace (Barney, 1991). Alternative models of competitive advantage exist which analyze the competitive environment in terms of factors external to the firm. Management theorists have determined that good environmental scanning involves factors social, technological, economic, political (Christensen et al., 1973) and ecological (Andrews, 1999) or natural (Afuah, 2009) in nature. These factors, frequently referred to as STEEP environmental factors, are considered competitive advantage shifters due to their propensity to cause innovations (Porter, 1990). Some definitions are provided in subsequent paragraphs and examples of several factors from this research are provided in Table 32.

STEEP Factor Identification

Social factors are those elements of the environment that relate the firm to individuals as well as groups in society. Some broad themes associated with these factors include changing work and leisure patterns, urbanization, changing world demographics, and equal opportunities in minority groups (Andrews, 1999). Following the changing social factors is an important facet of new market identification and demand satiation (Drucker, 1985; Porter, 1990). Technology are the tools and techniques used to perform functions in an organization, and include the discoveries of science, incremental improvements to machinery and processes, and automation and data processing (Andrews, 1999). Ecological environmental factors or 'physical' factors (Christensen, et. al., 1973) are environmental characteristics advantageous to industrial development and include transportation, environmental quality standards, and production facility location considerations (Andrews, 1999).

Economic activities are those activities associated with the production, trade and consumption of goods and services in and between countries (Merriam-Webster, 2012). In 2008, firms around the globe realized the importance of paying attention to the interconnectedness of the economic environment due to the housing market crash in the US. Other contributing factors include foreign trade developments, globalization, industry structure changes in emerging markets, recession and inflation (Andrews, 1999). Political factors, among the slowest to change of the environmental

factors, involve relational pairs of private enterprise and government, communist and non-communist countries, rich and poor, or worker and organization (Andrews, 1999).

The environmental factors involved in this research were identified via literature review and case study of hardwood veneer industry firm top management in the United States and Austria, and confirmed via subject matter experts in both regions (some examples of which are provided in Table 32). The impacts of these environmental areas to each innovation area (i.e., sources of supply, production methods, markets, products and services, and business models) were tested via survey research and further insights produced via strengths, weaknesses, opportunities and threats (SWOT) Analysis.

Table 32. Examples of STEEP factors used in this research

	Examples
Political	• Export trade policies • Current government regulations
Economic	• Currency exchange rates • Global economic crisis • Labor costs
Social	• Consumer quality expectations • Changing global demographic
Technology	• Supply chain and slicing technological advances • Technological advances outside the industry
Ecological	• Availability of raw materials, including certified logs • Company location

SWOT Analysis

Barney (1991) depicted the relationship between the internal, resource-based view of the firm and the influence of the external environment on industry attractiveness. A SWOT analysis can be conducted to further understand these relationships in the hardwood veneer industry. The internal strengths and weaknesses of theoretical clusters of firms can be identified through their possession of different types of innovation resources. The external opportunities and threats can be identified relative to the theoretical clusters through survey responses to environmental factor impact on innovation area survey items. The identification and analysis of the relationship between the internal and external industry environment can provide the insights necessary for developing recommendations for strategies that will overcome the challenges facing the hardwood veneer industry.

Objectives

The objectives of this study are to:

1) Develop a model that describes the environmental impacts to innovation strategies in the hardwood veneer industry, and

2) Provide recommendations to hardwood veneer firms to help them innovate given the environmental impacts.

Methods

Survey Research

A survey was conducted on the top management of hardwood veneer firms in the United States, Austria and Germany to determine the impacts of five external environmental factors (i.e., social, technological, economic, ecological, and political) on their firms' innovation activities in five main areas (i.e., sources of supply, production methods, markets, products and services, and business models). The survey items were created based on results from a case study conducted on representatives from the hardwood veneer industry and environmental experts in Austria and the United States during summer 2009. The previous chapter described the methods used to create and administer this survey instrument, as well as how preliminary analyses were conducted.

The survey instrument tested 25 different impacts on innovation from the external environment. A list of the specific impacts and the survey items used to measure these impacts can be found in Appendix H. A five-point Likert scale was used to assess top management's agreement with which each survey item described an environmental factor that impacted innovation in their company (1 = strongly disagree, 3 = neither agree nor disagree, 5 = strongly agree).

Tests of Normality

To ensure that the appropriate statistical methods were used in the study, a Shapiro-Wilk test was conducted to determine if the data followed a normal distribution. In this test, a significance level below 0.05 indicates that the null hypothesis (i.e., H_0 = data are normally distributed) should be rejected. Non-parametric statistical methods should be used if the data do not follow a normal distribution.

Tests of Reliability

Methods regarding tests of reliability and validity follow those described in (Jonsson, 2000). Reliability is a measure of the ability for the study to be replicated to obtain similar results. Two tests of reliability were conducted in this study: 1) a test of non-response bias and 2) a test of inter-item reliability within the scale items. Non-response bias was tested by gathering information from non-respondents via telephone and internet research in order to compare the characteristics of companies that did not respond to the survey to those that did. This information collected included the reason for not responding and characteristics about the company (i.e., company type and size) to determine if there might be bias in the survey results.

The internal consistency of items within the scales was measured for reliability using Cronbach's correlation alpha. This reliability test measures the average correlation coefficient of each item in a scale as compared with all other items in the scale, weighting subject to the number of scale items. For new scales, a Cronbach's alpha of 0.6 is acceptable, with 0.7 preferred (Flynn et al., 1990; Hair et al., 1998). Scale items determined not to be internally consistent with other survey items (i.e., having a Cronbach's alpha below 0.6) should be removed.

Tests of Validity

Validity is a measure of the extent to which a scale measures what it is intended to measure and nothing else. Content validity of the survey items for this study was deemed an important measure of validity. Content validity, a subjective measure that the content of the survey measures the concepts they are intended to measure, is a variant of construct validity. Content validity can be established through identification of concepts that are repeated in relevant literature, and through expert analysis of the survey items for relevant content. Both methods were used to establish content validity in this survey.

Construct validity, a measure of the extent to which survey items measure the theorized constructs they are intended to measure, is used to examine correlations among survey items to ensure the items representing a construct fit an expected pattern. Construct validity is used for new scales for which the criterion for measuring a construct are not known (Cronbach and Meehl, 1955). It is necessary to measure construct validity for the constructs themselves and not the interactions among constructs. Therefore, construct validity was not measured in this study, as the survey items all correspond to interactions between two constructs (i.e., economic factor impacts to source of supply innovations,

etc.) and not to measuring the constructs themselves (i.e., economic factors, source of supply innovations, etc.).

Alternatively, a measure of the strength of the relationship between survey items intended to measure the same interactions (i.e., two survey items relating economic impacts to source of supply innovations, etc.) called the effect size of each variable was measured using Cohen's d. The means of responses across all survey respondents (Austrian, German and American) for each pair of survey items were subtracted and related to the pooled standard deviation using the following formula:

$$Cohen's\ d = \frac{(m_1 - m_2)}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2}}}$$

where m_1 and m_2 are the sample means of survey items 1 and 2 for a given pair, n_1 and n_2 are the number of responses of survey items 1 and 2, and s^2_1 and s^2_2 are the squared sample standard deviations of survey items 1 and 2 (Cohen, 1988). Cohen (1988) considered effect sizes of 0.2 small, 0.5 medium and 0.8 large.

Cluster Analysis

The companies' responses to environmental impacts were analyzed by way of cluster analysis. Cluster analysis is a data analysis technique that groups companies having similar intrinsic characteristics with one another. In this case, the intrinsic characteristics are the companies' reactions to environmental variables. The clusters were formed such that the companies within a cluster responded more similarly to the environment than they did to companies outside the cluster. The method used to differentiate the companies' responses was Ward's minimum variance method, which hierarchically groups companies based on the differences of their variances from the mean response of the dataset. Four methods for determining the number of cluster partitions were calculated and compared to select the appropriate number of partitions for analysis: the cubic clustering criterion, between-cluster sum of squares, R-squared, and semi-partial R-squared. Variable variances were used instead of eigenvalues to determine the cubic clustering criterion, which minimizes the within-cluster sum of squares. The number of partitions was selected based on the most prevalent results from all four methods, in addition to the 'best cut' represented on the dendrogram (Everett et al, 2001).

Following cluster formation and determination of the number of cluster partitions to use for further analysis, the partitions were compared based on mean survey responses of survey items for the five innovation areas and the five environmental factors combined. Non-parametric methods were used to compare the mean responses due to the ordinal nature of the survey data. Namely, the Wilcoxon signed-rank test was used to test the paired differences of the means. Based on the results, cluster partitions were described based on the impacts to innovation by environmental factors and further described based on percentages of innovation resource information for companies in each cluster partition. Results from these analyses were used to create a model of environmental impacts to innovation in the hardwood veneer industry. Trends gleaned from these analyses were also utilized to create recommendations for companies to create innovation strategies that could more aptly compete given the impacts from environmental factors.

Model Development

In precursory steps of this theory-building process, a hypothetical model of environmental impacts to innovation was developed and substantiated with evidence from interviews of top management of hardwood veneer companies from the United States, Austria and Germany and environmental experts from the Europe and the United States. The model created can be seen in Figure 17. The model depicts the five innovation areas as they are utilized in the firm, with products and services flowing through the internal supply chain of the company (from sources of supply, through production to sales and markets) and the business model playing an active role in decision-making for each of the other innovation areas. The model also depicts each of the environmental factors having varying degrees of impact (denoted with larger lettering and bold text indicating greater impacts) on the entire innovation system of the firm.

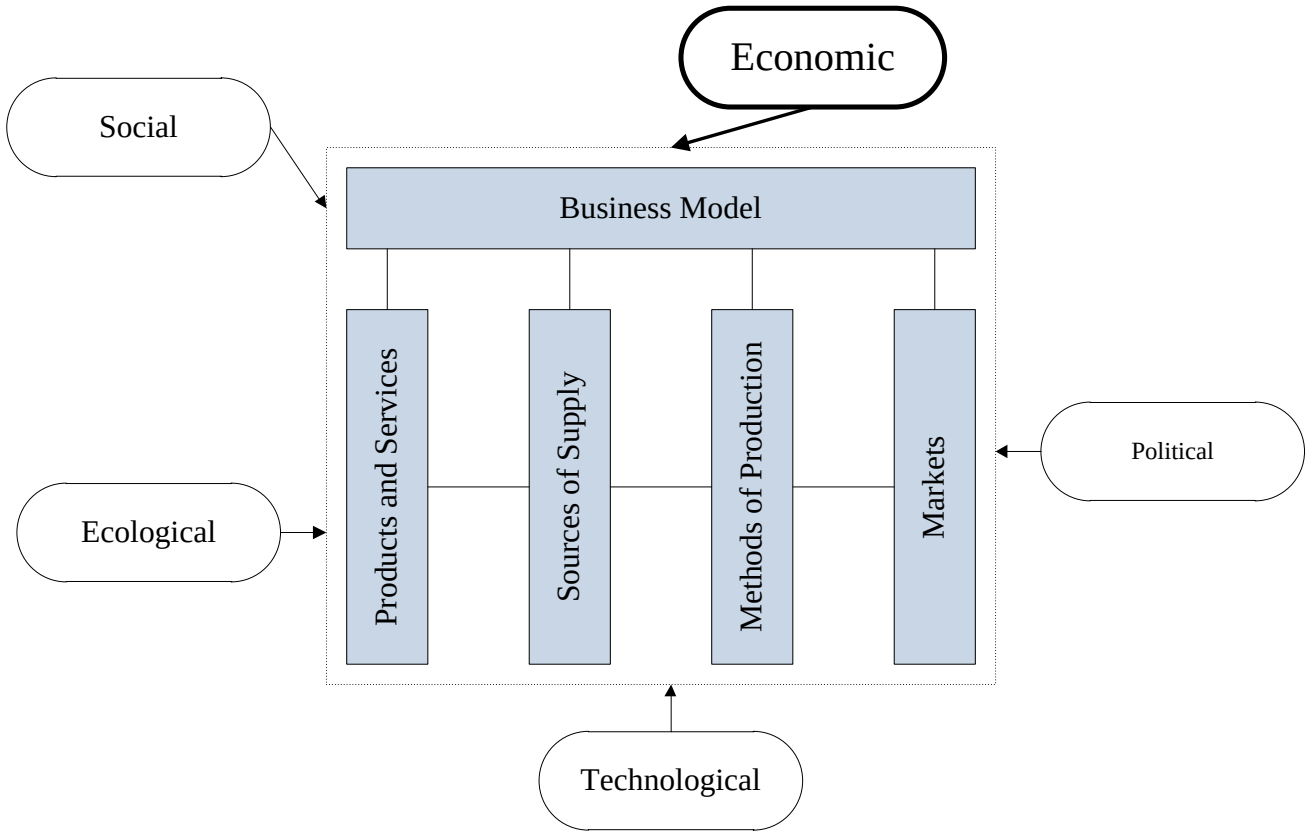


Figure 17. Hypothetical model of environmental impacts to innovation in the hardwood veneer industry

Based on the results of the cluster analysis, the model will be adapted to incorporate new information identified in the survey about the environmental impacts to each innovation area.

Results

Results of Tests for Normality

Results from the Shapiro-Wilk test on one question from each of the innovation areas can be seen in Table 33, and a table of all the results from this test on all survey items can be found in Appendix I. The results of the test on all 50 survey items of environmental impacts to innovation concluded that the data do not follow a normal distribution. Therefore, non-parametric statistical methods were used in this study.

Table 33. Results from Shapiro-Wilk test of normality for environmental impacts to the five innovation areas

Innovation Area	Shapiro-Wilk W statistic	t-approximation
Sources of Supply	0.8377	< 0.0001
Methods of Production	0.8969	< 0.0001
Markets	0.8537	< 0.0001
Products and Services	0.8626	< 0.0001
Business Models	0.8931	< 0.0001

Results of Tests for Reliability

Non-response bias tests were conducted and results reported in the previous chapter. The adjusted response rate for the survey was 60% (86% from the United States, 43% from Austrian and 47% from German companies). There were a total of 39 companies that did not respond to the survey, 49% of which could not be reached for comment as to why they did not respond. Twenty-eight percent of the remaining non-respondents indicated that they were not interested in taking this survey, which was the main reason for non-response. Of the companies that did not respond, 54% were veneer trading companies, and 62% employed less than 50 people. Twenty-three percent of companies did not indicate what type of company they represented and 7.5% did not indicate the number of people they employed. In comparison to the respondents of the survey, who were 37% veneer trading companies and 67% employed fewer than 50 people, the non-respondents seem to follow suit in terms of the main company type and size of survey respondents.

The internal consistency of items within the scales was measured for reliability using Cronbach's correlation alpha. This reliability test measures the average correlation coefficient of each item in a scale as compared with all other items in the scale, weighting subject to the number of scale items. The results from this analysis can be found in Table 34. Scale items determined not to be internally consistent with other survey items (i.e., having a Cronbach's alpha below 0.6) should be removed. As a result of this analysis, none of the scale items were removed from further data analysis based on their reliability.

Table 34. Inter-item reliability test results on combined scale items of environmental impacts to innovation

Scale Name	Mean	Standard Deviation	Cronbach's Alpha
Environmental Impacts to Sources of Supply			
SS*SOC	5.67	1.57	0.87
SS*TECH	5.35	1.53	0.87
SS*ECOL	5.27	1.76	0.88
SS*ECON	5.97	1.79	0.87
SS*POL	5.75	1.48	0.87
Environmental Impacts to Production Methods			
PM*SOC	5.93	1.70	0.87
PM*TECH	6.27	1.85	0.87
PM*ECOL	5.95	2.00	0.87
PM*ECON	5.72	1.66	0.87
PM*POL	5.42	1.70	0.87
Environmental Impacts to Markets			
MA*SOC	6.29	2.08	0.87
MA*TECH	5.47	1.67	0.86
MA*ECOL	5.79	1.91	0.87
MA*ECON	5.40	1.98	0.87
MA*POL	4.76	1.85	0.87
Environmental Impacts to Products and Services			
PS*SOC	5.86	1.57	0.87
PS*TECH	5.59	1.54	0.87
PS*ECOL	5.73	1.74	0.87
PS*ECON	4.92	1.68	0.87
PS*POL	5.41	1.46	0.87
Environmental Impacts to Business Models			
BM*SOC	6.02	1.46	0.87
BM*TECH	5.72	1.61	0.87
BM*ECOL	5.84	1.60	0.88
BM*ECON	5.53	1.74	0.88
BM*POL	5.59	1.51	0.88

Results of Tests for Validity

Content validity was established through a thorough examination of relevant literature for concepts of environmental factors that impact innovation specific to the wood products industry, and more specifically, to the hardwood veneer industry. Once the survey was created, experts in the hardwood

veneer industry and in each of five environmental factor areas (i.e., social, technological, economic, ecological, and political) from the United States and Europe (primarily Austria and Germany) were asked to pre-test the survey to identify content that was not valid for the survey population and the impacts to innovation areas (i.e., sources of supply, methods of production, markets, products and services and business models). None of the survey items were changed from a theoretical standpoint as a result of the expert and industry representative pretests.

Effect size was measured between survey items which represented an impact of the environment on innovation (i.e., economic impacts to source of supply innovations, etc.). Table 35 displays the results of this analysis in Austria/Germany, the United States and the combined survey responses for both of these areas for all variables, with large effect sizes written in bold red text. Corresponding tables indicating the means and standard deviations for these three data sets can be found in Appendix J.

From these results, we can see that there are several survey items whose means were very different. For example, the political impacts on sources of supply as well as to business models were very different from one question to the other and from region to region. The survey items related to social impacts on sources of supply were also very different across all regions. Essentially, the effect size indicates that one of the survey items used to measure the impact between an environmental factor and an innovation area had a greater mean response (i.e., a larger effect) than the other. This knowledge can help interpret the survey results further.

Table 35. Cohen's d results for survey response items relating each environmental factor with each innovation area for Austrian/German, United States, and combined response groups

		Supply Sources	Production Methods	Markets	Products/ Services	Business Models
Political	Aus/Ger	-.47	-.09	.06	.48	**.84**
	US	**-1.13**	-.16	.61	.22	.80
	Both	**-.84**	-.12	.35	.35	**.81**
Economic	Aus/Ger	.03	.79	.06	-.08	.44
	US	.50	.56	**-1.02**	-.58	.51
	Both	.28	.64	-.49	-.33	.52
Social	Aus/Ger	**.99**	.00	-.17	.28	.05
	US	**3.30**	.18	-.15	-.27	-.16
	Both	**2.38**	.09	-.16	.02	-.06
Technological	Aus/Ger	.15	.73	-.20	.22	.14
	US	-.19	.00	.71	.47	.13
	Both	-.03	.44	.25	.37	.14
Ecological	Aus/Ger	**-1.18**	**.86**	.01	.01	-.19
	US	.43	.31	.46	.37	-.25
	Both	-.32	.64	.25	.19	-.21

Results of Cluster Analysis

Cluster analysis was completed using SAS statistical software via a hierarchical agglomeration method of clustering called Ward's minimum variance method. Under this method, the differences of the variances of the mean of the data set were used to group the companies. The first analysis used all survey respondents across all regions. Four methods (i.e., cubic clustering criterion, R-squared, semi-partial R-squared, and between cluster sum of squares) of determining the optimum number of cluster partitions were calculated and compared to identify the primary clusters in this data. These results can be found in Appendix K. Under each method except the cubic clustering criterion, the optimum number of clusters can be identified by the distance between the letters on the graph, with greater distances indicating greater significance of the existence of that cluster. Under the cubic clustering criterion method, the position of the highest letter on the chart indicates the optimum number of clusters. In this example, the between-cluster sum of squares and semi-partial R-squared indicate that four clusters would be optimal; the cubic clustering criterion indicates that three clusters would be optimal; and R-squared indicates that a potential fifth cluster might be the optimal number of clusters.

In addition, the 'best cut' method of identifying cluster partitions represented on the dendrogram was utilized, as seen in Appendix L. Under this method, the vertical lines with the greatest distance from the top of the graph would be the most optimal clusters formed from the data. A red line has been added to the dendrogram to denote the 'best cut' line. From the dendrogram, we can see three distinct clusters have formed, with the company identification numbers circled for each cluster. Below these clusters, the next longest line is to only one firm, which would not provide for adequate comparisons with the other clusters. From these methods of identifying the number of cluster partitions, three clusters were chosen for further analysis.

Subsequently, the mean responses for each of the survey items relating to an environmental factor (see Table 36) and innovation area (see Table 37) were compared for the clusters. The Wilcoxon signed-rank test was utilized to compare the equality of the means from this ordinal data, and significance levels were used to determine which clusters were unique based on their means. From the data in Table 36 and Table 37, it can be seen that a majority of the results from this test proved equality of the mean differences among the clusters. Significant results from the comparison of means have p-values highlighted in red in the tables.

Table 36. Comparison of means for environmental factors by cluster partitions including survey responses from all companies in Austria, Germany and the United States
(C1 = Cluster partition 1, C2 = Cluster partition 2, and C3 = Cluster partition 3)

Environmental Factor	**Mean**			**W-statistic**			**t-approximation**		
	C1	*C2*	*C3*	*C1&C2*	*C1&C3*	*C2&C3*	*C1&C2*	*C1&C3*	*C2&C3*
Social	2.89	3.04	3.23	76.0	82.5	359.0	0.3849	**0.0427**	**0.0483**
Technological	2.61	2.91	3.08	66.5	86.0	373.5	0.1560	0.0569	0.0901
Economic	2.76	3.06	2.83	68.0	128.5	555.5	0.1843	0.6877	0.0514
Ecological	2.98	3.04	2.98	81.0	131.5	477.5	0.5683	0.7702	0.7165
Political	2.58	2.84	2.81	67.0	102.5	488.5	0.1659	0.1792	0.5578

Table 37. Comparison of means for innovation areas by cluster partitions including survey responses from all companies in Austria, Germany and the United States
(C1 = Cluster partition 1, C2 = Cluster partition 2, and C3 = Cluster partition 3)

Innovation Area	Mean			W-statistic			t-approximation		
	C1	*C2*	*C3*	*C1&C2*	*C1&C3*	*C2&C3*	*C1&C2*	*C1&C3*	*C2&C3*
Sources of Supply	2.83	2.88	2.88	87.5	134.5	473.5	0.8571	0.8552	0.7776
Production Methods	2.90	3.19	3.14	78.0	119.5	490.5	0.4541	0.4659	0.5305
Markets	2.66	2.97	3.01	69.0	96.5	455.0	0.2043	0.1211	0.9436
Products and Services	2.66	2.82	2.92	82.5	115.5	425.5	0.6305	0.3831	0.5054
Business Models	2.77	3.03	2.97	58.0	88.5	504.0	0.2810	0.2652	0.3691

Given that the cluster analysis results including all companies surveyed from both regions proved insignificant, subsequent cluster analyses were conducted on survey responses from the United States separately from those of Austria/Germany. This analysis identified two main clusters in the United States and two main clusters in Austria/Germany (see dendrograms for these two clusters in Appendix L). Means for survey responses of survey items relating to the five environmental factors (see Table 38) and the five innovation areas (see Table 39) were compared using the Wilcoxon signed-rank test in a similar fashion to the combined data analysis. Significant results from the comparison of means have p-values highlighted in red in the tables. From the results, it can be seen that the clusters identified in the survey responses from US hardwood veneer companies were significantly different, while the mean survey responses from Austrian/German companies in each cluster were only significantly different in terms of technological impacts.

Table 38. Comparison of means for environmental factors between cluster partitions of survey responses in the United States and in Austria/Germany

Environmental Factor	United States				Austria/Germany			
	Cluster partition 1	*Cluster partition 2*	*W-statistic*	*t-approx*	*Cluster partition 3*	*Cluster partition 4*	*W-statistic*	*t-approx*
Social	3.20	3.07	157.5	0.4311	2.87	3.18	21.5	0.2121
Technological	3.28	2.93	187.0	**0.0412**	2.13	3.04	6.0	**0.0129**
Economic	3.11	2.60	209.5	**0.0036**	2.80	3.12	19.5	0.1552
Ecological	3.29	2.99	197.5	**0.0139**	2.90	2.91	34.5	0.9275
Political	3.19	2.66	215.5	**0.0018**	2.33	2.80	14.5	0.0649

Table 39. Comparison of means for innovation areas between cluster partitions of survey responses in the United States and in Austria/Germany

Innovation Area	United States				Austria/Germany			
	Cluster partition 1	*Cluster partition 2*	*W-statistic*	*t-approx*	*Cluster partition 3*	*Cluster partition 4*	*W-statistic*	*t-approx*
Sources of Supply	3.00	2.60	204.5	**0.0063**	3.03	3.07	37.5	0.9273
Methods of Production	3.28	3.10	179.5	0.0820	2.67	3.17	24.5	0.3225
Markets	3.30	2.85	216.0	**0.0017**	2.40	2.97	16.0	0.0869
Products and Services	3.18	2.75	200.0	**0.0107**	2.50	2.91	26.0	0.3846
Business Models	3.31	2.94	198.0	**0.0122**	2.43	2.92	12.0	**0.0426**

One final comparison of the means was conducted in order to ensure that the most appropriate clusters were used in further analysis. This comparison of the means included the two clusters of US companies identified in Table 38 and Table 39, as well as a cluster including all of the Austrian/German companies combined into one cluster. Results from this comparison, again using the Wilcoxon signed-rank test to compare mean responses of survey items relating to all five environmental factors and all five innovation areas, can be seen in Table 40 and Table 41, respectively. Significant results from the comparison of means have p-values highlighted in red in the tables.

Table 40. Comparison of means for environmental factors between cluster partitions in the United States and a cluster partition including all Austrian/German survey responses
(C1 = US Cluster partition 1, C2 = US Cluster partition 2, and C3 = Aus/Ger Cluster partition 3)

Environmental Factor	Mean			W-statistic			t-approximation		
	C1	*C2*	*C3*	*C1&C2*	*C1&C3*	*C2&C3*	*C1&C2*	*C1&C3*	*C2&C3*
Social	3.20	3.07	3.02	157.5	160.5	452.0	0.4311	0.6315	0.6390
Technological	3.28	2.93	2.59	187.0	195.5	461.5	**0.0412**	0.0595	0.8055
Economic	3.11	2.60	2.96	209.5	144.0	316.0	**0.0036**	0.8670	**0.0006**
Ecological	3.29	2.99	2.90	197.5	213.5	516.0	**0.0139**	**0.0106**	0.3149
Political	3.19	2.66	2.57	215.5	222.5	445.0	**0.0018**	**0.0041**	0.5251

Table 41. Comparison of means for innovation areas between cluster partitions in the United States and a cluster partition including all Austrian/German survey responses
(C1 = US Cluster partition 1, C2 = US Cluster partition 2, and C3 = Aus/Ger Cluster partition 3)

Innovation Area	Mean			W-statistic			t-approximation		
	C1	*C2*	*C3*	*C1&C2*	*C1&C3*	*C2&C3*	*C1&C2*	*C1&C3*	*C2&C3*
Sources of Supply	3.00	2.60	3.07	204.5	133.0	305.3	**0.0063**	0.5318	**0.0003**
Production Methods	3.28	3.10	3.10	179.5	181.0	463.0	0.0820	0.1855	0.8323
Markets	3.30	2.85	2.89	216.0	212.5	463.5	**0.0017**	**0.0119**	0.8414
Products and Services	3.18	2.75	2.86	200.0	206.5	426.5	**0.0107**	**0.0209**	0.2873
Business Models	3.31	2.94	2.86	198.0	222.0	508.0	**0.0122**	**0.0044**	0.4116

The results indicate that there were significant differences between the means of innovation area responses to environmental factors for C1 and C2 of US companies. There were some significant differences between the Austrian/German cluster (C3) and C1 of US companies, but not between C2 and C3. The average response rate per question for the Austrian/German companies was lower (87%) than for the US companies (96%), which indicates that a lack of data may impair interpretation of the clustering and representation of innovation resources of Austrian/German companies with other clusters.

Understanding the Cluster Analysis Results

Following identification of the different clusters of hardwood veneer companies, several analyses were conducted on this data in order to understand the underlying impacts involved in creating this partitioning and the innovation resources of the companies within each cluster. The first analysis conducted was a comparison of the means among pairs of clusters of the impacts of particular environmental factors on particular innovation areas based on the responses to two survey items. These impacts and their related survey items are listed in Appendix H. Table 42 shows the results of the Wilcoxon rank-sum test comparing the means of these clusters, with significant comparisons highlighted in bold red text. The results of this comparison indicate that there may be particular impacts at play in the partitioning of the clusters of US hardwood veneer companies.

A further analysis of the survey items that comprise these impacts was conducted by comparing the mean response of each of the survey items for the two clusters. Results of this can be found in Appendix M. Only two of the survey items were identified to be significantly different from C1 to C2, 4 items from C1 to C3 and 2 items from C2 to C3, as seen highlighted in red bold text in the tables in Appendix M. For each of the remaining impacts, both survey items were not found to have

significantly different results between companies in the two clusters. Interpretation of the results will include the survey items whose mean responses between the two clusters were not significantly different.

Table 42. Comparison of means of impacts between cluster partitions of survey responses of all US companies

Impact	Means			W-statistic			t-approx.		
	C1	*C2*	*C3*	*C1&C2*	*C1&C3*	*C2&C3*	*C1&C2*	*C1&C3*	*C2&C3*
SS*SOC	3.06	2.74	3.09	162.5	153.0	419.0	0.305	0.864	0.208
SS*TECH	2.83	2.64	2.90	189.0	160.5	376.5	**0.032**	0.627	**0.028**
SS*ECON	3.22	2.74	3.33	178.0	151.5	386.5	0.084	0.930	**0.043**
SS*ECOL	2.89	2.17	2.97	165.5	169.5	443.0	0.243	0.367	0.480
SS*POL	3.00	2.71	3.16	199.0	126.5	330.5	**0.010**	0.365	**0.002**
PM*SOC	3.06	3.17	3.13	182.0	222.0	552.0	0.061	**0.004**	0.063
PM*TECH	3.61	3.24	3.23	168.5	194.5	528.0	0.194	0.060	0.192
PM*ECON	3.22	2.95	3.16	193.0	140.5	350.5	**0.020**	0.750	**0.006**
PM*ECOL	3.06	3.40	3.21	104.5	124.0	518.5	0.114	0.297	0.271
PM*POL	3.44	2.76	2.73	159.0	194.5	549.5	0.383	0.058	0.069
MA*SOC	3.67	3.02	3.48	187.5	185.0	433.5	**0.035**	0.122	0.354
MA*TECH	3.22	2.98	2.69	192.5	182.0	404.0	**0.021**	0.160	0.107
MA*ECON	3.06	2.36	3.13	159.0	145.5	404.5	0.380	0.913	0.092
MA*ECOL	3.44	3.24	2.90	194.5	202.5	442.0	**0.016**	**0.024**	0.466
MA*POL	3.11	2.64	2.31	177.0	211.5	553.0	0.094	**0.012**	0.060
PS*SOC	2.83	3.14	3.04	159.5	175.0	481.5	0.357	0.133	0.836
PS*TECH	3.44	2.81	2.86	198.0	204.0	439.0	**0.011**	**0.022**	0.420
PS*ECON	3.00	2.21	2.80	154.5	142.0	423.0	0.496	0.795	0.237
PS*ECOL	3.44	3.07	2.75	173.0	183.5	471.5	0.125	0.143	0.990
PS*POL	3.17	2.52	2.80	164.0	195.5	546.5	0.265	0.053	0.078
BM*SOC	3.39	3.26	2.89	151.5	197.0	570.5	0.584	**0.046**	**0.021**
BM*TECH	3.28	2.98	2.89	108.5	139.5	522.5	0.154	0.718	0.233
BM*ECON	3.06	2.71	2.93	175.5	141.0	398.0	0.091	0.764	0.076
BM*ECOL	3.61	3.07	2.74	130.5	136.5	463.5	0.684	0.612	0.832
BM*POL	3.22	2.67	2.87	185.5	171.5	402.5	**0.043**	0.339	0.097

Subsequently, an analysis was conducted to determine the innovation resource survey responses of companies in each of the clusters. This analysis included counts of the number of companies included in each innovation resource area and the percentage that number of companies represented across all survey respondents in the cluster. The results from this analysis can be found in Table 43.

Table 43. Innovation resources of companies included in the clusters

Innovation Resources	United States				Austria/Germany	
	Cluster 1		*Cluster 2*		*Cluster 3*	
	# companies	*%*	*# companies*	*%*	*# companies*	*%*
Number of companies	9	100%	21	100%	30	100%
Company type						
Veneer traders	4	44%	1	5%	16	53%
Custom slicers	1	12%	8	38%	9	30%
Veneer manufacturers	4	44%	12	57%	5	17%
Company age						
0-9 years	2	22%	0	0%	2	7%
10-29 years	2	22%	4	19%	12	40%
30-49 years	3	34%	10	48%	9	30%
50 + years	2	22%	7	33%	7	23%
Geographic region						
< 50 miles from hotspot	5	56%	3	14%	6	20%
Other region	4	44%	18	86%	24	80%
Company size						
< 50	4	44%	8	38%	27	90%
50-99	0	0%	4	19%	0	0%
100-199	3	33%	4	19%	2	7%
> 200	1	11%	5	24%	1	3%
Value of sales						
< $4.9 million	2	23%	5	24%	19	63%
$5-9.9 million	1	11%	4	19%	5	17%
> $10 million	5	56%	10	48%	3	10%
International presence						
Only in the home country	2	22%	5	24%	11	37%
Operate globally, HQ in home country	7	78%	15	71%	17	57%
Operate in home country, HQ elsewhere	0	0%	1	5%	1	3%

Additional selected innovation resources of the companies in the US and Austrian/German clusters were compared in Table 44. These innovation resources are more oriented toward innovative aspects of the firms.

Table 44. Selected innovation resources of companies included in the clusters

Innovation Resources	United States				Austria/Germany	
	Cluster 1		*Cluster 2*		*Cluster 3*	
	# of companies	%	# of companies	%	# of companies	%
Patents						
None	9	100%	18	86%	23	77%
1 or more	0	0%	3	14%	2	7%
Annual trade show attendance						
IWF-Atlanta	6	66%	14	67%	2	7%
AWFS-Las Vegas	6	66%	3	14%	0	0%
imm-Cologne	5	55%	9	43%	6	20%
interzum-Guangzhou	2	22%	1	5%	2	7%
interzum-Moscow	1	11%	0	0%	1	3%
LIGNA	2	22%	3	14%	3	10%
Other trade shows	0	0%	2	10%	1	3%
Trade association membership						
Hardwood Veneer Association (HVA)	4	44%	10	48%		
American Hardwood Export Council (AHEC)	2	22%	4	19%		
International Wood Products Association (IWPA)	0	0%	2	10%		
Architectural Woodwork Institute (AWI)	3	33%	5	24%		
Hardwood Manufacturers Association (HMA)	0	0%	5	24%		
National Hardwood Lumber Association (NHLA)	3	33%	2	10%		
Other associations	1	11%	2	10%		
Initiative Furnier + Nature e.V.					1	3%
proHolz Austria					10	33%
Hauptverband der Deutschen Holzindustrie (HDH)					0	0%
Verband der Deutschen Moebilindustrie (VDM)					3	10%
Innovation strategy						
Regular	3	33%	8	38%	12	40%
Niche	1	11%	6	29%	10	33%
Resource-building	1	11%	3	14%	5	17%
Revolutionary	3	33%	4	19%	3	10%

It is interesting to note that the innovation resource items of trade association membership and annual trade show attendance do not include all companies. This is a result of the lack of participation by hardwood veneer companies in these events. In terms of trade association membership, respondents indicating 'Other' on the survey were asked to write in the name of the association not listed in the survey to which their company was a member. These trade associations are: International Hardwood Lumber Association (IHLA), Hardwood Plywood and Veneer Association (HPVA), United States Green Building Council (USGBC) and Sägeswerkverband. The adjusted response rate for this question among US companies was 32% and among Austrian/German companies was 30%.

In terms of trade shows attended annually, there were 4 companies that indicated 'Other' trade shows they attend as: Architectural Woodwork Institute (AWI) Annual Convention, Indiana Hardwood Lumbermen's Association (IHLA) Annual Convention and ZOW Bad Salzuflen. The adjusted response rate for this question among US companies was 52% and among Austrian/German companies was 37%.

Discussion

One of the primary goals of this research was to provide guidance for firms in the hardwood veneer industry to innovate and sustain themselves despite the industry's status as a mature industry facing an array of competitive challenges. However, the firms in this industry have evolved into an agglomeration of firms, each with unique defining characteristics and business management strategies. Fitting a model for innovation to an industry with such a high level of individuality of firms was a complex task. Valuable comparisons of how companies interact with their external environment to innovate were gleaned from the results. This broadened knowledge base was used to develop recommendations that hardwood veneer companies can use to develop their innovation strategies with awareness towards external impacts in the future.

Cluster Analysis Results

Some differences between the clusters can be construed from the innovation resource data. C1 and C3 seem to represent more veneer trading companies, while C2 includes a predominant number of veneer manufacturers and custom slicing companies. In addition, the companies in C2 are older, on average, than those in C1 and C3. The firms in C2 are also located in regions other than the 'hot spot' of the US hardwood veneer industry (i.e., within 50 miles of Indianapolis, IN, or Louisville, KY). C2 also seems to represent companies with greater numbers of employees than C1 or C3,

which is logical given that manufacturing firms need additional employees to procure raw materials and in operations than trading companies would need in terms of sales and administrative staff. US clusters (C1 and C2) seem to have lower value of sales than Austrian/German companies (C3), and but seem to be fairly evenly distributed in terms of international presence.

Companies in C2 and C3 hold more patents (3 and 2, respectively) than C1 (0), but they are less involved in trade shows and trade association memberships than C1. This makes sense because aside from direct sales, manufacturers would also have trading companies buying from them. Trading companies would need to establish more relationships with secondary wood products manufacturers, which could be the reason for attending more trade shows and attempting to be more networked into the industry via trade association membership. This also makes sense for C3 firms because they have a larger, more concentrated customer base for hardwood veneer and would not need to put forth as much effort into networking as a US trade company might. In general, companies in C2 and C3 also seem to have innovation strategies that focused more on their use of existing resources (i.e., regular and niche strategies), while companies in C1 were equally split on their use of new versus existing resources. This is a logical phenomenon for US manufacturing companies, given the huge investment in plant, property and equipment manufacturing companies must make in order to operate, that they would want to use them for a variety of purposes, including innovation. Almost half of the companies in the Austrian/German cluster are veneer manufacturers, so this makes some sense for C3 as well.

Overall, the companies in C1 indicated more positive impacts to innovation from all significant environmental factors than C2 and C3, and C3 exhibited more positive impacts than C2 (see tables in Appendix M for results). In terms of economic impacts, sources of supply and production methods were the innovation areas most affected, with a significant difference in the impact of sources of supply from C2 to C3 in terms of affordability of domestically sourced raw materials. Firms from C2 noted negative impacts, while C3 firms noted positive impacts. This might be an indicator of regional price differences in the cost of logs from US to Austria/Germany. It could also be a result of the demographics of the clusters, with C2 representing primarily manufacturing companies while C3 is half manufacturers and half trading companies. The trading companies in C3 likely purchase their raw materials (i.e., veneer) from the manufacturers, and might be buffered from any price increases in veneer logs. Both firms from C2 and C3 noted positive impacts from exchange rates on raw material sourcing. Additionally, from C1 to C2 and from C2 to C3, firms noted differences in the impacts of

economic factors to production methods in terms of the improvement made from collaborating with educational institutions, though all mean responses were negative. Collaborations with educational institutions involve capital, time and risk, which may prove to be a seemingly infeasible alternative for a firm to invest in. When these same clusters were compared in terms of the lack of available capital improving production methods, all clusters noted positive differences. The methods for producing products in a mature industry are also very standardized, and most innovations involve improvements rather than radical changes to the way things are done (Williamson, 1975). The lack of available capital creates an opportunity for the firm to innovate by incremental means in order to be more efficient, as seemingly more pressing aspects of a company's strategy may require capital and attention.

Technological factors were noted to impact sources of supply, markets and products and services most, with significant differences noted in technological impacts to product and services innovations between C1 and C3 firms and C1 and C2 firms. C1 (or US trading companies) were always higher in terms of the positive impacts to innovation in all three areas, as compared to C2. Manufacturing companies in C2 might be more focused on using technology to improve their production methods, as opposed to sources of supply, markets or products and services. Advancements in veneer slicing technology had a greater negative impact on the ability of C2 firms to utilize a broader range of log qualities than C3 firms. These firms would be more impacted by slicing technology than C1 firms, as they represent veneer manufacturers. However, C3 firms also tend to note better availability of log qualities and affordability of logs than C2 firms, which might impact this trend. In addition, supply chain technology has had a greater negative impact on the ability of C2 firms to find and track new sources of supply than C1 or C3 firms. This is likely largely due to the demographics of the clusters as manufacturing versus trading companies. Supply chain technology was noted as having a positive impact on finding or entering new markets, but negative impacts in terms of identifying new products and services. Technologies outside the hardwood veneer industry had impacts to products and services as well as markets which were positive or not impacting C1 firms and negatively impacting C2 firms. Once again, this seems to be a demographic trend between the clusters.

Political factors played a different role in the sources of supply of clusters containing manufacturers and trading companies than the cluster containing primarily manufacturers. All firms noted the Lacy Act as having a more positive impact on their trade in terms of raw material sourcing, but C2 firms noted less positive impacts than C1 or C3 firms. Part of this may stem from the persistent debate

regarding the export of logs to foreign countries (namely China) (Luppold, 1994), a practice that is thought to have stymied US domestic hardwood veneer manufacturers' ability to source adequate qualities of North American species (Freeman, 2009). While the Lacy Act has been in place since the early 1900s, changes to the act made in 2008 have placed increasing scrutiny on the sources of wood supplies. From a veneer consumers' perspective, the Lacy Act has been 'burdensome' in terms of compliance because the definition is not clear as to what constitutes compliance (NPR, 2011). Most of the companies in both clusters operate internationally, but it's possible that more of the onus regarding compliance with export trade policies and the Lacy Act has been put on veneer manufacturers. In terms of export trade policies impacting domestic raw material sourcing, all firms reported negative impacts. However, C3 trading companies reported significantly greater negative impacts than the US C2 manufacturers, and also greater impacts than the US C1 trading companies. These differences are likely due to the raw materials each different type of firm is attempting to source (i.e., veneer logs versus veneer).

Political factors significantly impacted market innovations between C1 and C3 firms. C1 firms noted more positive impacts for trade association and government policies aiding new market development, while C3 firms noted negative impacts. Business models were also impacted from political factors in C1 and C2 firms, with negative impacts to both clusters in terms of current regulations helping firms create global marketplace competitive advantages. C1 trading firms had more positive impacts from legal restrictions on lending allowing value-creating reorganizations than C2 manufacturing firms. It is possible that through the inability for these trading companies to get capital, they have eliminated waste to become more efficient. Yet, veneer manufacturers still view this as a burden on their ability to add value through reorganization, perhaps due to the capital intensity such reorganization would require.

Markets, production methods and business models were impacted by social environmental factors. Regional consumer product preferences were deemed to have a significantly more positive impact on the trading firms in Cluster 1 than the manufacturers of Cluster 2. It is possible that the markets veneer trading companies tend to attempt entering may be different from those of veneer manufacturers, given veneer traders' propensity to attend trade shows. It is also possible that the limitations of producing veneer in terms of raw material availability (Luppold, 1994) could trickle downstream to a decreased ability to provide the variety of species and qualities of veneer regional consumers are demanding. Veneer traders could have more flexibility in terms of the veneer they

purchase and could respond quicker to changes in regional consumer demands than a veneer manufacturer might. Cultural differences had primarily positive impacts on both US trading companies and US manufacturing and custom-slicing firms. The percentage of firms in each cluster did not greatly differ in terms of their international presence.

Austrian/German companies had different impacts to production methods and business models from social environmental factors than US companies had. Workforce demographic factors had a positive impact on production methods of both regions' trading clusters (C1 and C3), but C1 had more negative impacts as a result of the need for a safer working environment on production method improvements than C3. It is possible some other environmental factor (like technology) might play a part in this phenomenon. In terms of business models, firms in C1 and C2 had more positive impacts from worker safety improvements causing value-generating business model changes as well as consumer demand changes causing valuable firm reorganizations as compared to C3 firms. Austrian/German firms might not be adapting their business models in order to accommodate changes in worker safety or consumer demand at all. It is also possible that the changes Austrian/German firms need to make to their business models do not generate value. Either way, it's interesting to note that accommodating for worker safety impacts the production methods and business models of US C1 firms differently.

The size of the veneer industry and the location of individual firms in the industry were the ecological factors tested as to their impacts on a firm's ability to find and enter new markets. C1 and C2 firms noted positive impacts to market innovations from both firm location and industry size. However, firm location was noted to have significantly different impacts to market innovations between C1 and C3 firms. US C1 trading companies noted positive impacts to market innovations from location, while C3 trading firms noted negative impacts.

A greater percentage of the German firms in C3 (77%) are located outside the Ruhr region of Germany (considered to be the industrial center of Germany) than the trading firms of C1 (44%) are located more than 50 miles outside of Indianapolis, IN, and Louisville, KY (cities considered to be the 'hot spots' for hardwood veneer industry firms). This is exemplary of the theory of Audretsch and Feldman (1996), which identified this characteristic of the norm in terms of geographic location of mature firms to innovation clusters. Innovative firms tend to 'need space' to operate, so they tend to move away from geographic hot spots of an industry (Audretsch and Feldman, 1996). However, the geographic location of a firm can then impact knowledge transfer about markets and customers

from one company to the next. Once farther away from their geographic hot spots, these firms may experience even more difficulties in keeping up with product preferences of consumers. Table 45 and Table 46 show more specifically the geographic areas where the firms in each of these clusters are located. Response rate for this survey question among US and Austrian/German respondents was 100%.

Table 45. Geographic locations of firms in each cluster of the US hardwood veneer industry

Geographic location	Cluster 1		Cluster 2	
	# of companies	*%*	*# of companies*	*%*
< 50 miles of Indianapolis, IN or Louisville, KY	5	56%	3	14%
Midwest (MO, IA, MN, WI, IL, IN, OH, or MI)	1	11%	12	57%
Northeast (DE, MD, DC, WV, ME, NH, VT, NY, MA, RI, CT, NJ or PA)	0	0%	2	10%
South (VA, KY, TN, AR, LA, MS, AL, NC, SC, GA, or FL)	2	22%	4	19%
Other	1	11%	0	0%
Total	9	100%	21	100%

Table 46. Geographic locations of Austrian/German hardwood veneer industry cluster firms

Geographic location	Cluster 3	
	# of companies	*%*
The Ruhr region of Germany	1	3%
Other parts of Germany	23	77%
Austria	5	17%
Other areas	1	3%
Total	30	100%

The Model

From the cluster analysis results listed in Table 42, the hypothetical model of impacts of environmental factors on innovation areas in the US hardwood veneer industry was updated. The model can be found in Figure 18, which indicates the differences between environmental factors impacting innovation between trading and manufacturing clusters in the US hardwood veneer industry. Figure 19 indicates the differences between US and Austrian/German hardwood veneer manufacturing clusters.

From the definition of sustainable competitive advantage by Barney (1991), industries exist to create products that 1) have value in terms of high market prospects and/or minimization of environmental risks, 2) are rare among industry competitors, 3) have imperfect imitability, and 4) cannot be easily substituted. Firms in the hardwood veneer industry have historically gained a competitive advantage by offering a valuable product, made from a rare resource (i.e., less than 1% of logs reach veneer quality (Hoover and Gann, 1999)), through a unique historical industry (and even firm-level) evolution. Until the recent prevalence of laminates and digital printing, the product was not easily substitutable.

From the model in Figure 18, we can more clearly see that the character of the hardwood veneer industry as a niche industry segment. Niche markets exist in part to serve a particular market segment whose needs are not being met by most providers. The model clearly illustrates that market innovations are most impacted by ecological, social and technological environmental factors. In the hardwood veneer industry, ecological impacts to markets could stem from the location of the firms in relation to customers, the firms' 'listening' skills of reading consumer preferences, or the technologies used to find new markets and provide product requirements. Niche markets also exist as a result of specialized technology required at different points in the supply chain. The model depicts three different points in the supply chain where impacts to innovation from technology could occur (i.e., products and services, sources of supply and markets). As a mature industry, the methods of producing veneer have become so standardized that firms may not be able to find new ways to gain competitive advantages from these areas. So technological impacts are more in the form of innovation that aid in developing new products and services for hardwood veneer and identifying new markets for both raw materials and end veneer products.

Figure 19 provides a glimpse of the differences between environmental factor impacts to innovation in the US versus Austrian/German hardwood veneer industries. Hardwood veneer companies can utilize both Figure 18 and Figure 19 to understand how the environment impacts their particular innovation strategies (represented by the innovation resources they use to support each of the innovation areas) differently than their competitors domestically and abroad.

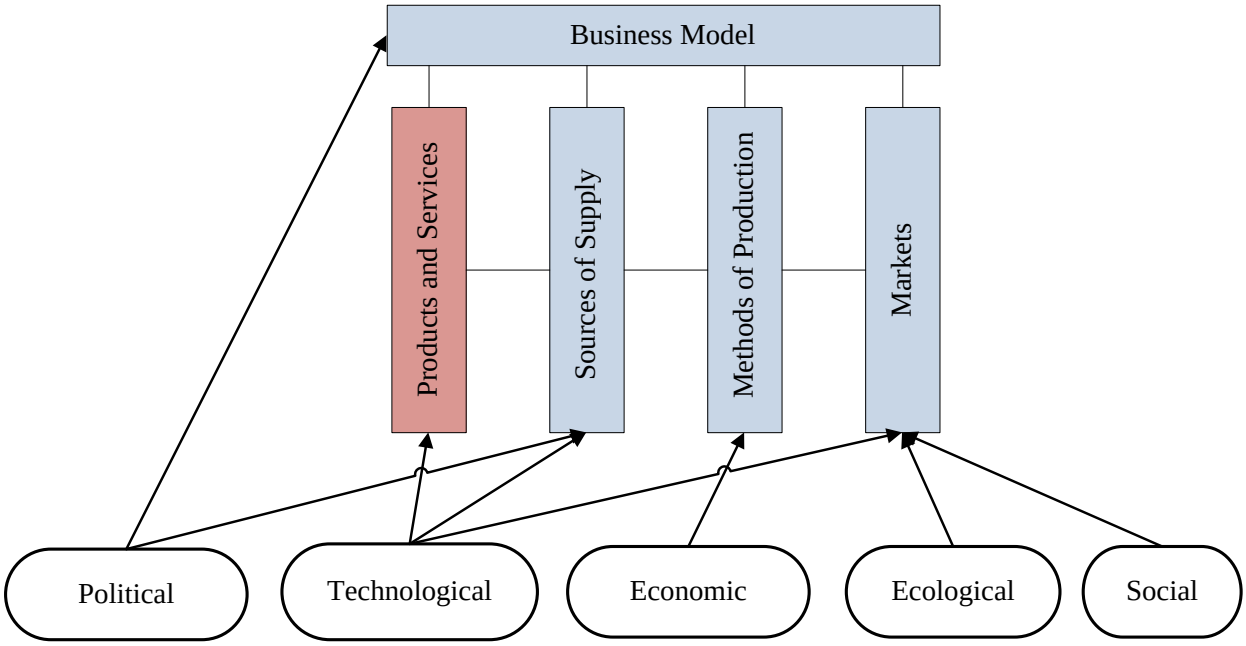


Figure 18. Model of environmental impacts to innovation that differ between trading companies and manufacturers in the US hardwood veneer industry

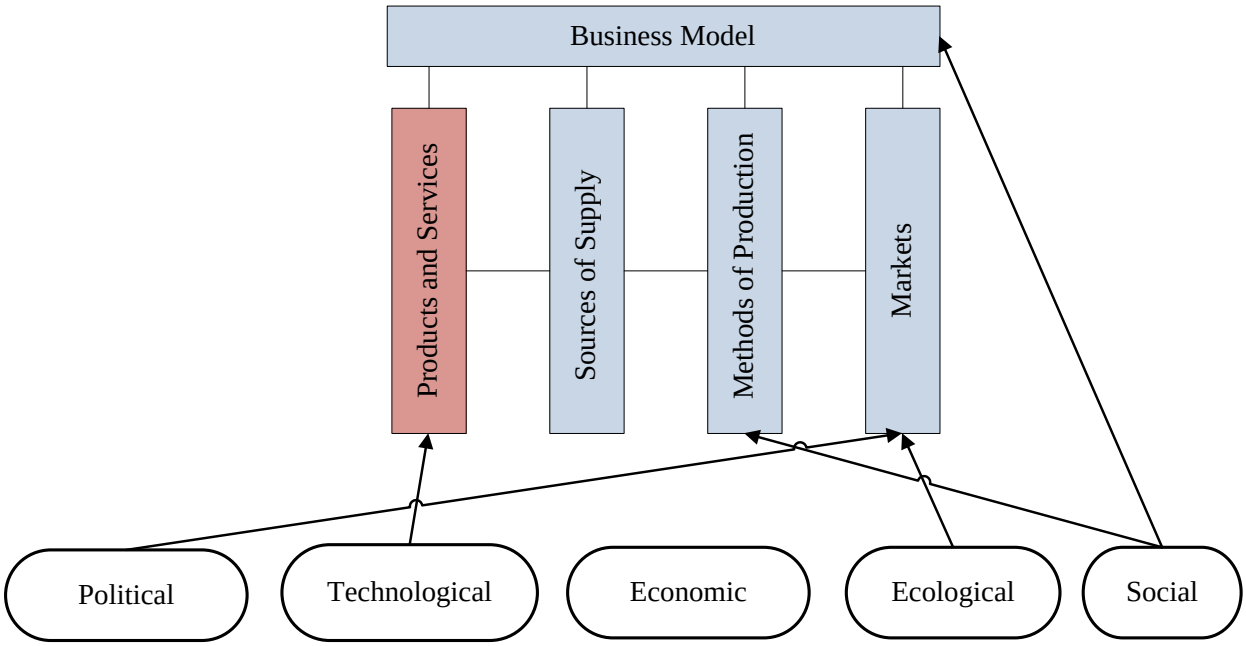


Figure 19. Model of environmental impacts to innovation that differ from hardwood veneer manufacturers in Austria/Germany to those in the United States

SWOT Analysis

The hardwood veneer industry seems to have created a market space that limits the amount of environmental impacts, most of which are from technological factors and to market innovations. Further insights can be gained from conducting a SWOT analysis on each theoretical cluster of firms. Table 47 and Table 48 show these SWOT analyses for each theoretical cluster in the United States and Table 49 shows the SWOT analysis for the Austrian/German cluster based on the results provided from the survey of hardwood veneer firms.

Table 47. SWOT analysis for Cluster 1 – US trading/manufacturing companies

Internal Analysis **(% of companies in the cluster)**	***External Analysis***
Strengths	**Opportunities**
International presence (78%) Geographic location (56%) Trade show attendance (89%) Trade association membership (67%) Firm size – number of employees (44% are > 100 employees and 33% are > 200) Firm size – value of sales (56% are > $10 million) Firm age (equal distribution)	New technologies aid firms' capabilities to find new markets Current government policies have helped to find or enter new markets Regional product preferences aided new market entrance International marketing efforts of trade associations has aided new market development Firm location offers a competitive advantage
Weaknesses	**Threats**
Patents (0%)	

Table 48. SWOT analysis for Cluster 2 – US manufacturing companies

Internal Analysis **(% of companies in the cluster)**	***External Analysis***
Strengths International presence (71%) Geographic location (86%) Trade show attendance (71%) Trade association membership (67%) Patents (14%) Firm size – number of employees (24% are > 200) Firm age (81% > 30 years old)	**Opportunities**
Weaknesses Firm size – annual sales (43% of 21 firms are < $10 million)	**Threats** Export trade policies inhibit domestic raw material sourcing Domestic raw materials aren't affordable New technologies have not aided firms' capabilities to develop or offer new products or services Regional consumer product preferences prevent new market entrance

Table 49. SWOT analysis for Cluster 3 – Austrian/German trading/manufacturing companies

Internal Analysis **(% of companies in the cluster)**	***External Analysis***
Strengths	**Opportunities**
Geographic location (80%) Firm age (equal distribution) Patents (7% with 1 or more) Trade show attendance (37%) Trade association membership (30%)	Export trade policies aid domestic raw material sourcing Domestic raw materials are affordable
Weaknesses	**Threats**
International presence (57%) Firm size – number of employees (10% are > 100) Firm size – value of sales (10% > €10 million)	New technologies haven't improved capabilities to develop and offer new products and services International marketing efforts of trade associations haven't aided new market development Current government policies prevent finding or entering new markets Location isn't a competitive advantage to find or enter new markets

Recommendations

1) Seek out opportunities for knowledge and technology transfer.

Both clusters indicated a lack of technological advancements in supply chain and slicing technologies. Networking is incredibly important for tacit knowledge transfer that spawns innovations. Though the indicated trade show attendance and trade association membership rates were relatively high for firms in both clusters, the response rate for these questions were only 52% and 32%, respectively. That could indicate that those companies not responding do not attend trade shows or have trade association memberships at all. Seek out opportunities to learn about tangential industries and the potential for developing new ways of operating with these industries that add value. Also look for opportunities outside of the hardwood veneer industry for supply chain technologies or methods that work well for other industries, and apply those that make sense to your firm.

2) Partner with educational institutions or technology companies to create efficiencies.

Both clusters also indicated a lack of collaborations with educational institutions to create production efficiencies. Firms could benefit from focused improvements and partnerships with either educational institutions or technology companies (i.e., slicing, supply chain, etc.) in order to create the desired efficiencies. Look for bottlenecks or problem areas in production (i.e., quality issues, inventory build-up, etc.) and identify some scientists at educational institutions who might be able to help. Posing questions and gaining insight is the first step to creating efficiencies that add value.

3) Get active in a trade association or industry political groups.

Firms from both US clusters also cited export trade policies as an inhibitor of raw material sourcing as well as current regulations not improving firms' abilities to create global marketplace competitive advantages. Making changes may require more critical mass than just hardwood veneer industry firms. Communicating the specific problems across multiple industries that face the same issues and joining forces may produce the necessary changes to source better raw materials and be more competitive on a global level. As the old saying goes, 'the squeaky wheel gets the grease'.

4) Identify white spaces where innovation strategies could be altered to create a competitive advantage.

Afuah's (2009) four innovation strategies used in this study can be graphed on a coordinate plane with markets and customers on the x-axis, resources and capabilities on the y-axis, and the four innovation strategy types occupying each quadrant. Identifying future innovation strategies would benefit from an attempt by firms to plot their position on this graphic in relation to their competitors. Firms can get a better idea of where they are in relation to their competitors and strategize competitive moves other industry moves may make.

In the Aeberhard Method of Global Environmental Analysis (Aeberhard, 1996), the STEEP variables can be understood in terms of their impact on the firm through a series of steps:

a) Identify the environmental elements necessary for analysis.

b) For each of the elements, describe important historical events and the current situations of each in a clear, concise manner.

c) Develop quantitative or qualitative future prognoses for each element.

d) Based on the consolidation of all future state prognoses, analyze the future environmental developments.

In this research, the first two steps of the Aeberhard method were conducted. As firms know better which environmental factors impact them the most, developing future scenarios for what changes may happen to the industry will help firms develop better strategies.

Conclusions

The hardwood veneer industry is comprised of firms each diverse in terms of their scope (i.e., veneer trading, custom slicing, or manufacturing) and scale (i.e., number of employees). Each innovation resource of a firm adds to the complexity in classifying firms based on similarities. From this study, it is evident that firms in the hardwood veneer industry are unique in the way their businesses are managed, how they respond to their external environment, and what types of strategies they employ to create new combinations of goods and services for customers. Imposing a structure on this complex network of firms may not provide meaningful guidance in the same capacity for each individual firm on their path to innovation. However, the trends described regarding environmental impacts to innovation warrant attention in terms of monitoring their changes and developing a strategy that encourages innovation in the sense most meaningful to each individual firm.

References

Abernathy, W.J. and K.B. Clark. (1985). Innovation: Mapping the winds of creative destruction. *Research Policy*. 14(1): 3-22.

Aeberhard, K. (1996). Strategische Analyse, Empfehlungen zum Vorgehen und zu sinnvollen Methodenkombinationen. Bern, Switzerland, Lang Verlag.

Afuah, A. (2009). Strategic Innovation: New Games for Competitive Advantage. New York, NY: Routledge

Andrews, K.R. (1999). The concept of corporate strategy. In: The Strategy Process : Concepts, Contexts, Cases. Mintzberg, H., J. B. Quinn and S. Ghoshal. London, UK, Prentice Hall. 51-60.

Audretsch, D.B. and M.P. Feldman. (1996). Innovative clusters and the industry life cycle. *Review of Industrial Organization*. 11: 253-273.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*. 17(1): 99-120.

Bathelt, H. and N. Schuldt. (2008). Between luminaries and meat grinders: International trade fairs as temporary clusters. *Regional Studies*. 42: 853-868.

Boer, H. and During, W.E. (2001). Innovation, what innovation? A comparison between product, process and organizational innovation. *International Journal of Technology Management.* 22(1,2,3): 83.

Callahan, J.C. (1990). The Fine Hardwood Veneer Industry in the United States: 1838-1990. Lake Ann, MI, National Woodlands Publishing Company.

Christensen, C.R., K.R. Andrews, and J.L. Bower. (1973). The company and its environment: Relating opportunities and resources. In: Business Policy : Text and Cases. Homewood, Ill., R. D. Irwin. xvii, 846 p.

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences. 2nd edition. Hillsdale, NJ: Lawrence Erlsbaum Associates, Inc.

Cronbach, L.J. and P.E. Meehl. (1955). Construct validity in psychological tests. *Psychological Bulletin*. 52(4): 281-302.

Drucker, P.F. (1985). The discipline of innovation. *Harvard Business Review* 63(3): 67-72.

Everitt, B.S., S. Landau, and M. Leese. (2001). Cluster Analysis, 4th Edition. New York, NY: Oxford University Press.

Flynn, B.B., S. Sakakibara, R.G. Schroeder, K.A. Bates, and E.J. Flynn. (1990). Empirical research methods in operations management. *Journal of Operations Management*. 9(2): 250-284.

Freeman, G. (2009). Hardwood Plywood and Veneer Association Chairman. Personal communication. November 6, 2009.

Hair, J.F., R.L. Tatham, R.E. Anderson, W.C. Black, and B.J. Babin. (2006). Multivariate Data Analysis. Upper Saddle River, NJ: Pearson Prentice Hall.

Hoover, W.T. and R.W. Gann. (1999). Indiana Forest Products Price Report and Trend Analysis. West Lafayette, IN, Purdue University Cooperative Extension.

Jonsson, P. (2000). An empirical taxonomy of advanced manufacturing technology. *International Journal of Operations & Production Management*. 20(12): 1446-1474.

Kirby, A. (1988). Trade associations as information exchange mechanisms. *The RAND Journal of Economics*. 19(1): 138-146.

Luppold, W.G. (1994). The U.S. hardwood log export situation: What is the problem? *Forest Products Journal* 44(**9**): 63-68.

Maskell, P. (2001). Towards a knowledge-based theory of the geographical cluster. *Industrial and Corporate Change*. 10(4): 921-943.

Maskell, P.; Bathelt, H.; and A. Malmberg. (2006). Building global knowledge pipelines: The role of temporary clusters. *European Planning Studies*. 14: 997-1013.

Maskell, P. and A. Malmberg. (1999). The competitiveness of firms and regions: 'Ubiquitification' and the importance of localized learning. *European Urban and Regional Studies*. 6(1): 9-35.

Merriam-Webster. (2012). Economy. Merriam-Webster Learner's Dictionary. Accessed February, 2012 at: http://www.learnersdictionary.com/search/economy[1].

Norwood, F.B. and J.L. Lusk. (2011). Social desirability bias in real, hypothetical, and inferred valuation experiments. *American Journal of Agricultural Economics*. 93(2): 528-534.

NPR. (2011). Why Gibson Guitar was raided by the Justice Department. The Record. National Public Radio. Accessed Jan 2, 2012 online at: http://www.npr.org/blogs/therecord/2011/08/31/140090116/why-gibson-guitar-was-raided-by-the-justice-department.

OECD. (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. Organization for Economic Co-operation and Development, Eurostat, European Commission.

Porter, M.E. (1990). The Competitive Advantage of Nations. New York, NY: The Free Press.

Rinallo, D. and F. Golfetto. (2011). Exploring the knowledge strategies of temporary cluster organizers: A longitudinal study of the EU fabric industry trade shows (1986 – 2006). *Economic Geography*. 84(4): 453-476.

Sauber, T. and H. Tschirky. (2006). Structured Creativity: Formulating an Innovation Strategy. Basingstoke [England]; New York, Palgrave Macmillan in association with the European Institute for Technology and Innovation Management.

Schumpeter, J.A. (1942). Capitalism, Socialism, and Democracy. New York, NY: Harper.

Schumpeter, J.A. (1939). Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process. New York, NY: McGraw-Hill Book Company, Inc.

USPTO. (2012). Patents. United States Patent and Trademark Office. Accessed February, 2012, online at: http://www.uspto.gov/patents/index.jsp

Wagner, E.R. and E.N. Hansen. (2005). Innovation in large versus small companies: Insights from the US wood products industry. *Management Decision*. 43(5/6): 837-850.

Williamson, O. E. (1975). Markets and Hierarchies: Analysis and Antitrust Implications. New York, NY: The Free Press.

Chapter 6: Summary, Conclusions and Future Research

Summary and Conclusions

The hardwood veneer industry is a niche industry sector within the forest products industry. Despite its small size, hardwood veneer firms provide an important function for the economic prosperity of the entire forest products industry. In terms of forest management, hardwood veneer trees comprise less than one percent of trees in the forest (Hoover and Gann, 1999). Managing for the size and quality of veneer trees is an important part of habitat management, as these trees require longer rotation ages than other types of wood products and can provide fodder for different species of animals during that time. As a raw material, hardwood veneer logs provide a means of product differentiation for loggers, sawmills and other wood products and timber traders, as hardwood veneer logs reap 1.5 to 6 times the price of a grade 1 sawlog (Wiedenbeck, et al, 2004). As an end product, the thin slices of hardwood veneer from one tree can be used in dozens of applications, thereby conserving the highest quality of wood product for the benefit and enjoyment of the most people.

Innovation is an important aspect of developing sustainable competitive advantages for firms in all industries. In a niche industry, like the hardwood veneer industry, innovation is of paramount importance to prevent substitute products and other threats from stealing market share and challenging product relevancy in the eyes of consumers. Developing effective strategies for innovation is one way to combat this threat.

The first objective of this research was to investigate the strategies hardwood veneer firms use to innovate. Hardwood veneer firms identified each of Schumpeter's five areas of innovation (i.e., sources of supply, methods of production, markets, products and services and business models) as areas they attempt to innovate in. Innovation strategies were found to be deliberate or emergent in nature, depending on the type of innovation and the firm in question. Innovation strategies also were found to be of four types: regular, resource-building, position-building or niche and revolutionary. These four types describe how firms leverage resources and capabilities to serve markets and customers. Innovation resources firms in the hardwood veneer industry can utilize in their innovation strategies are: firm size (in terms of value of sales and number of

employees), firm age, geographic location, attendance at trade shows, trade association memberships, patents, and international presence.

Environmental scanning or boundary scanning is an important activity for firms to perform for developing management strategies. The second objective of this research was to describe how environmental factors impact innovation strategies of hardwood veneer industry firms. This research provided firms with an overview of some important environmental factors facing the hardwood veneer industry from a local and global perspective. These factors are social, technological, ecological, economic and political in nature (commonly called STEEP factors). Firms involved in this study were grouped into clusters of firms exhibiting similar impacts from environmental factors. The innovation resources in use by each cluster of firms was then analyzed to identify patterns of behavior that could be used to describe how these impacts could be combated by changing firm strategy. The impacts from environmental factors were found to be significantly different for certain environmental factors and their impacts on certain areas of innovation (i.e., political factors on sources of supply, technological factors on products and services, etc.). By validating the impacts of environmental factors on innovation most pertinent to the hardwood veneer industry, better strategies can be developed to maintain relevancy of the industry in the face of environmental threats. This research provided a model for strategic innovation and the impacts to innovation for the hardwood veneer industry to use as a guide.

The third objective of this research was to compare the innovation strategies and their influential environmental impacts in Austrian/German and American hardwood veneer firms. One cluster of firms from Austria/Germany was compared against the two clusters of American firms to identify significant differences in the way these clusters responded to environmental factors for each innovation area. It was found that some innovation areas were more impacted (i.e., markets) by environmental factors than others and that some environmental factors (i.e., social) impacted innovation areas more than others. The differences between the regions were noted and described in a model.

The final objective of this study was to develop recommendations for the hardwood veneer industry to improve their innovation strategies given existing environmental conditions. Several recommendations were proposed that will help firms discern the innovation strategies in use in

their own firms and how to gain a better competitive position in the face of the most predominant environmental factors impacting them.

Finally, this study helped to further understanding of how environmental factors influence and impact innovation. Methodologies were used in this study that could be replicated to help further the theoretical understanding of environmental impacts on business performance to gain competitive advantages. The completion of interviews and surveys by hardwood veneer industry top management is one way awareness was increased of the concept of innovation, the innovation strategies their firms might employ, and their need to develop innovation strategies to combat the impacts of external environmental factors. By disseminating the findings of this research, hardwood veneer industry firms, as well as other wood products firms, can identify environmental factors at play external to their firms that might present opportunities or threats to their innovativeness.

From this research, firms can better discern which innovation resources they possess and how they may be combined into an innovation strategy for their firm. This research has helped to broaden the base of knowledge of hardwood veneer industry management on strategic innovation. Company management can review the information regarding innovation strategies currently in use in the industry and determine what options they have for innovating. This research has helped to maintain a valuable, mature, niche sector of the wood products industry.

Study Limitations

There are numerous limitations of conducting any research study that could be identified and expounded upon at length. In this research study, a few main limitations were sources of frustration at different points on the path to project completion. These limitations involve scale, scope, and timeframe of the study.

The hardwood veneer industry is a niche industry composed of about 36 companies in the United States, 20 companies in Austria and 61 companies in Germany. The nature of hardwood veneer industry firms to be incredibly unique in order to gain competitive advantages in such a small marketplace makes differentiation of clusters of firms complicated. In addition, the hardwood veneer industry as a niche industry within the entire wood products industry limits the interpretation of the results. More sophisticated, powerful statistical methods for assessing

construct validity of the survey and for cluster analysis require much larger sample sizes than are available. A study comprised of additional sectors of the entire wood products industry would have been beneficial in gaining insights to the nature of firms in a mature industry producing commodity products that interact with similar environmental factors.

In addition, relationships were a driving factor for obtaining good quality information from survey respondents about how their companies face the challenge of innovating in today's world. Within such a small industry like the hardwood veneer industry, relationships are incredibly important to gaining valuable information. There were some firms who admitted to not participating in the study because they did not know the researcher personally and did not trust someone they had only received e-mails and/or phone calls from. Though the response rates from both regions surveyed were excellent, the lack of personal relationship with the survey respondents was a limitation that is notable. If larger sample sizes were to be used, this could still be the case. However, when conducting future research on a small, tight-knit group of companies, networking is of utmost importance for gaining the best data possible.

The focus of this study was to gain a broader understanding of the impacts from the environment on innovation in a selected industry. Innovation resources of individual firms were identified and used to understand and differentiate the clusters. A measure of innovativeness of each firm was not taken. Valuable comparisons could be made by comparing the innovativeness of a firm with the innovation resources they utilize in their strategies and how environmental factors are impacting their innovativeness.

Each of the environmental factors has the potential to change at any time, and they often do change frequently. The results today may not be as meaningful as they were while the study was being conducted. An example of this is the impact of the economic crisis. Today the situation in the United States is relatively more stable and less risky than it was in 2009 when some of the data was being collected. In addition, the economic situation in Europe might be less stable today than it was in 2009, and therefore economic impacts to innovation might play a greater role than social factors in European hardwood veneer firms. The results of this study should be considered as a snapshot in time. Constant boundary scanning of the firm should take place in order to identify the environmental factors that have the potential to impact the firms' innovation strategies, and actions should be taken to counterbalance these impacts.

Recommendations for Future Research

Innovation is a current buzzword that intrigues many people, from business practitioner to politician. Future research in order to understand innovation and how companies can be more innovative is imminent. Successive research efforts should aim to minimize those issues deemed limitations from this study, while furthering the understanding of innovation in the forest products industry.

First, attempts have been made in the literature to measure innovativeness of wood products industry firms (Hovgaard and Hansen, 2004; Kaplinsky and Readman, 2005; Wagner and Hansen, 2005; Cao and Hansen, 2006; Crespell and Hansen, 2008; Bonsi, 2009; Quesada-Pineda, 2010). The ability to benchmark companies against one another and against their own performance in the area of innovation would provide direct benefits to firms in terms of gaining sustained competitive advantages in the marketplace. Future research efforts would be wise to provide some more distinct measure of innovativeness of firms.

This research is the first attempt to understand impacts from factors outside an industry that might be affecting innovation. Firms were questioned for their understanding of these impacts, as well as environmental experts. The environmental experts noted that their specific environmental area was also impacted by other environmental areas. These interactions might be depicted as a matrix, within which a firm and an entire industry must operate. Future studies might also be conducted to understand the interactions of environmental factors on one another.

An interesting finding from this study is that many of the firms interviewed did not mention a comprehensive list of the environmental factors impacting the hardwood veneer industry. Only a couple of factors were gleaned from each company. Part of this may have been due to the brevity of the interviews (of about an hour each) and the difficulty recalling many factors in a short amount of time. It would, however, be interesting to determine what types of boundary scanning activities are being used by all wood products firms and to conduct additional studies on how other forest products industry sectors understand the environmental factors impacting the industry. As a result of this study being on a niche market, future studies should include identifying the environmental factors that might be different from industry segment to segment. This could be beneficial not only in terms of helping companies develop better business

management strategies, but also in terms of marketing and promoting wood as a building material (in comparison to steel or concrete, for example).

References

Bonsi, R. (2009). Adoption of Bamboo in Ghana's Forest Products Industry: An Investigation of the Principle Exporter's and Institutions. PhD dissertation. Blacksburg, VA: University Libraries, Virginia Polytechnic Institute and State University.

Cao, X. and E.N. Hansen. (2006). Innovation in China's furniture industry. Forest Products Journal. 56(11/12): 33-42.

Crespell, P. and E. Hansen. (2008). Managing for innovation: Insights into a successful company. Forest Products Journal. 58(9): 6-9.

Hoover, W.T. and R.W. Gann. (1999). Indiana Forest Products Price Report and Trend Analysis. West Lafayette, IN, Purdue University Cooperative Extension.

Hovgaard, A. and E. Hansen. (2004). Innovativeness in the forest products industry. Forest Products Journal. 54(1): 26-33.

Kaplinsky, R. and J. Readman. (2005). Globalization and upgrading: what can (and cannot) be learnt from international trade statistics in the wood furniture sector? Industrial and Corporate Change. 14(4): 697-703.

Quesada-Pineda, H. (2010). Innovation activities in the primary wood products sector: A case study. Wood and Fiber Science. 42(4): 511-522.

Wagner, E.R. and E.N. Hansen. (2005). Innovation in large versus small companies: insights from the US wood products industry. Management Decision. 43(5/6): 837-850.

Wiedenbeck, J.K., M. Wiemann, D. Alderman, J. Baumgras, and W.G. Luppold. (2004). Defining Hardwood Log Quality Attributes. NE-313. Newtown Square, PA, USDA Forest Service, Northeastern Research Station.

Appendices

Appendix A. Prices Paid for Delivered Veneer Logs by Indiana Mills, 1998-1999 and 2007-2008 Data

Species/Log Diameter for Prime Grade Logs	1999 Mean	% Change from 1998	2008 Mean	% Change from 2007
Black Walnut				
12-13	1627	1.7	2391	-4.4
14-15	2350	21.6	3473	-4.2
16-17	2900	10.5	4209	9.6
18-20	3882	29.4	6820	27.9
21-23	4583	46.7	7700	21.6
24-28	5429	73.7	9250	-2.6
28+	5400	72.8	9500	-5
White Oak				
13-14	1169	-11.2	1583	-23.4
15-17	1565	2.1	2195	21
18-20	1975	7.5	2622	31.1
21-23	2225	14.8	3064	22.6
24-28	2588	18.3	3700	64.4
28+	2917	33.3	3800	68.9
Black Cherry				
12-13	NA	NA	1729	NA
14-15	NA	NA	2478	-29.2
16-17	NA	NA	3375	22.7
18-20	NA	NA	4433	-1.5
21-23	NA	NA	5000	0.0
24-28	NA	NA	5400	-10.0
28+	NA	NA	5400	80.0
Red Oak				
16-17	1304	4.3	1094	13.1
18-20	1385	10.8	1250	19.0
21-23	1375	-8.3	1640	82.2
24-28	1446	-3.6	1720	91.1
28+	1383	-7.8	1840	104.4
Hard Maple				
16-20	1941	21.3	2150	14.7
20+	2060	23.6	2783	85.5
Yellow Poplar				
16-20	600	9.1	700	27.3
20+	683	13.8	720	30.9

Source: (Hoover and Gann, 1999; Hoover, 2008)

Appendix B. Selected Information on Ghana's Veneer Market

Sliced Face Veneer, FOB	***€/sq.m.***			
Species	**Face**		**Backing**	
	Dec. 2008	*Dec. 2009*	*Dec. 2008*	*Dec. 2009*
Afrormosia	1.80	1.19	1.00	1.00
Asanfina	2.00	1.50	1.20↑	.80
Avodire	1.12	1.20	.80	.90
Chenchen	1.00↑	1.20	.55	.54
Mahoghany	1.40	1.42	.79	.89
Makore	1.90↑	1.40	.90	.85
Odum	1.66	1.80	1.00	1.15

Source: (ITTO, 2009a; ITTO, 2009b)

Appendix C. Interview Guide (in English)

General Information

Name of the Interviewee:_____

Place and Date of the Interview:_____

Greeting

I am conducting a research project about innovation strategies of firms in the hardwood veneer industry. My objectives for the research are to investigate strategies firms use to innovate, to identify environmental factors that impact the innovation strategies of hardwood veneer industry firms, and to offer recommendations that will help hardwood veneer industry firms develop effective innovation strategies given the environmental influences. All of the information you provide today will be kept confidential. When reporting the results of this research project, there will not be a way to identify your responses from those of other research participants. Interviews of European and North American firms will take place from July to December 2009. After all interviews have been completed, you may be asked to fill out a survey regarding the environmental factors that impact your firm.

The purpose of our interview today is to gather information about your firm's innovation strategies. Innovation is defined as beginning or introducing something new. I am investigating the goals, policies and actions your firm has taken to innovate in five main areas: sources of supply, methods of production, markets, business models and products/services. Before we begin, I would like to ask your permission to record this conversation for future research analysis. Following the publication of my dissertation, all recorded conversations will be destroyed. Do you agree to have this interview recorded?

Interview Questions

1. Please describe a time when your firm began or introduced a new source of supply.

    - Was this a goal of your firm?

    - What policies do you have in place to guide firm employees in identifying new sources of supply?

-What actions did you take upon identification of this new source of supply?

2. What was the greatest factor external to your firm that affected/affects your search for a new source of supply? Why?

3. Please describe a time when your firm began or introduced a new method of production.

-Was this a goal of your firm?

-What policies do you have in place to guide firm employees in identifying new methods of production?

-What actions did you take upon identification of this new method of production?

4. What was the greatest factor external to your firm that affected/affects your search for a new method of production? Why?

5. Please describe a time when your firm began or introduced a new market.

-Was this a goal of your firm?

-What policies do you have in place to guide firm employees in identifying new markets?

-What actions did you take upon identification of this new market?

6. What was the greatest factor external to your firm that affected/affects your search for a new market? Why?

7. Please describe a time when your firm began or introduced a new business model.

-Was this a goal of your firm?

-What policies do you have in place to guide firm employees in identifying new business models?

-What actions did you take upon identification of this new business model?

8. What was the greatest factor external to your firm that affected/affects your search for a new business model? Why?

9. Please describe a time when your firm began or introduced a new product or service.

-Was this a goal of your firm?

-What policies do you have in place to guide firm employees in identifying new products or services?

-What actions did you take upon identification of this new product or service?

10. What was the greatest factor external to your firm that affected/affects your search for a new product or service offering? Why?

Appendix D. Interview Guide (in German)

Allgemeine Informationen

Name des Gesprächspartner:_____

Ort und Datum des Interviews:_____

Begrüssung

Ich betreibe ein Forschungsprojekt ueber die Innovationsstrategien von Firmen in der Furnierindustrie. Meine Forschungsziele sind 1) die Innovationsstrategien von Firmen zu erforschen, 2) die Umweltfaktoren, die die Firmen in der Furnierindustrie beeinfluessen zu bestimmen, und 3) Empfehlungen an Firmen zu geben, um Ihre Innovationsstrategien zu entwickeln mit Beruecksichtigung der gegebenen Umweltfaktoren. Alle Angaben, die Sie mir heute geben, werden vertraulich behandelt. Im Bericht dieses Forschungsprojektes werden keine individuellen Informationen aus den Gespraeche veroeffentlicht. Interviews von Europaeischen und Nord Amerikanischen Firmen werden zwischen Juli und Dezember 2009 stattfinden. Nachdem alle Interviews gefuehrt wurden, werden Sie unter Umstaenden gebeten, einen Fragebogen ueber Umweltfaktoren, die Ihrer Firma beeinfluessen auszufuellen.

Das Ziel des heutigen Interviews ist, Informationen ueber die Innovationsstrategien Ihrer Firma zu erfassen. Innovation ist als der Anfang oder die Einfuehrung von etwas Neuem definiert. Ich erforsche die Ziele, das Verfahren, und den Ablauf Ihrer Firma, welche der Optimierung der fuenf Hautgebiete dienen: neue Betriebstoffsquellen, neue Produktionsmethode, neue Maerkte, neue Geschaeftsformulare, und neue Produkte oder Dienstleistungen. Bevor wir das Interview beginnen, moechte ich Sie um Erlaubnis bitten das Interview fuer zukuenftige Forschungsanalyse aufzunehmen. Nach der Herausgabe der Forschungsergebnisse, werden die Aufnahmen geloescht. Darf ich dieses Interview aufnehmen?

Interview Fragen

1. Bitte nennen Sie einen Zeitpunkt, wann Ihre Firma eine neue Quelle von Betriebstoffe angefangen oder eingefuehrt hat.

    - War das das Ziel Ihrer Firma?

-Welche Methode (Policen, Grundsaetze) leitet Firmenmitarbeiter um neue Betriebstoffsquellen zu bestimmen?

-Was haben Sie nach der Bestimmung der neuen Quelle von Betriebstoffen getan? Welchen Ablauf haben Sie durchgefuehrt?

2. Welcher externe Einfluss war Ihrer Firma am wichtigsten, um die Suche nach neuen Quellen der Betriebstoffe zu beeinfluessen? Warum?

3. Bitte beschreiben Sie einen Zeitpunkt, wann Ihre Firma eine neue Produktionsmethode angefangen oder eingefuehrt hat.

- War das das Ziel Ihrer Firma?

-Welche Methode (Policen) leitet Firmenmitarbeiter um neuen Produktionsmethoden zu bestimmen?

-Was haben Sie nach der Bestimmung der neuen Produktionsmethode getan? Welchen Ablauf haben Sie durchgefuehrt?

4. Welcher externe Einfluss war am Wichtigsten fuer Ihre Firma, um die Suche nach neuen Produktionsmethoden zu beeinfluessen? Warum?

5. Bitte Beschreiben Sie einen Zeitpunkt, wann Ihre Firma eine neue Markt angefangen oder eingefuehrt hat.

- War das das Ziel Ihrer Firma?

-Welche Methode (Policen) leitet Firmenmitarbeiter um neuen Maerkte zu bestimmen?

-Was haben Sie nach der Bestimmung des neuen Marktes getan? Welchen Ablauf haben Sie durchgefuehrt?

6. Welcher externe Einfluss war am Wichtigsten fuer Ihre Firmas, um die Suche nach neuen Maerkten zu beeinfluessen? Warum?

7. Bitte Beschreiben Sie einen Zeitpunkt, wann Ihre Firma ein neues Geschaeftsformular angefangen oder eingefuehrt haben.

- War das das Ziel Ihrer Firmas?

-Welche Methode (Policen) leitet Firmenmitarbeiter um neue Geschaeftsformulare zu bestimmen?

-Was haben Sie nach der Bestimmung des neuen Geschaeftsformulars getan? Welchen Ablauf haben Sie durchgefuehrt?

8. Welcher externe Einfluess war am Wichtigsten fuer Ihre Firma, um die Suche nach neuen Geschaeftsformulare zu beeinfluessen? Warum?

9. Bitte beschreiben Sie einen Zeitpunkt wann Ihre Firma ein neues Produkt oder eine neue Dienstleistung angefangen oder eingefuehrt hat.

- War das das Ziel Ihrer Firma?

-Welche Methode (Policen) leitet Firmenmitarbeiter um neue Produkte oder Dienstleistungen zu bestimmen?

-Was haben Sie nach der Bestimmung des neues Produktes oder der neuer Dienstleistung getan? Welchen Ablauf haben Sie durchgefuehrt?

10. Welcher externe Einfluss war am Wichtigsten fuer Ihrer Firma, um die Suche nach neuen Produkten oder Dienstleistungen zu beeinfluessen? Warum?

Appendix E. Survey Correspondence and Questionnaire (in English)

Pre-Survey E-mail

From: Amy D. Jahnke

Sent: Monday @ 8AM

To: [Veneer company recipients]

Subject: Virginia Tech Veneer Survey

Dear [personalized name],

Next Monday you will receive an invitation to participate in a survey about innovation in the hardwood veneer industry. The purpose of this survey is to help your company and the hardwood veneer industry better understand the factors that impact innovativeness in the industry. Current business models show that innovative firms are more competitive and profitable in their market segments. The results of this study will provide insight into the innovation tendencies of the veneer industry and the factors that prevent innovation from occurring. By taking a few minutes to complete this survey, you will be greatly helping both the veneer industry and me with my graduate research project at Virginia Tech! In addition, your participation will make you eligible for a prize drawing to be held in December.

I hope you will participate!

Sincerely,

Amy D. Jahnke
Graduate Research Assistant
Virginia Tech
Department of Wood Science and Forest Products
230 Cheatham Hall (0323)
Blacksburg, VA 24061
adjahnke@vt.edu
540-808-3572

Survey Invitation E-mail

From: Amy D. Jahnke

Sent: Monday @ 8AM after Pre-survey e-mail

To: [Veneer company recipients]

Subject: Virginia Tech Veneer Survey Invitation

Dear [participant name],

As you know, the hardwood veneer industry has been dramatically impacted by the recent economic downturn. One way for firms to better compete in the 21st century is to be more innovative, a trait the wood products industry is not often considered to have. This study aims to understand the innovation tendencies of firms and the impacts to firm competitiveness in the hardwood veneer industry. I am writing to ask for your help in identifying the causes of a lack of innovation in the industry and to provide suggestions for improvement.

You were selected as part of a sample of industry representatives from the hardwood veneer industry in the United States to complete this survey about your firm's innovation tendencies. Since the number of hardwood veneer firms is limited, your participation is vital to the success of the study. The results should help your company and the veneer industry by identifying areas where innovativeness can be improved. The survey should take you about 20 minutes to complete.

I would really appreciate your taking a few minutes to complete the veneer survey. Please cut and paste the following link into your web browser and use your 5-digit access code to gain access to the survey:

https://survey.vt.edu/survey/entry.jsp?id=1292293254535

Access Code: ***** (i.e., String of 5 digits unique to each firm)

Your responses to the survey will be kept confidential and your participation in this survey is voluntary. If you come to a question you do not want to answer, skip to the next one. This research project has been reviewed and approved by the Virginia Tech Institutional Review Board, and if you have questions about your rights as a participant, please contact Dr. David M. Moore, at 540-231-4991 or moored@vt.edu. For all other questions or comments about this

research, please direct your inquiries to me at the contact information below or to Dr. Bob Smith, at 540-231-7679 or rsmith4@vt.edu.

After completing the survey, your name will be entered in a drawing for a wooden desktop clock or a hardcover edition of the book, *Remarkable Trees of Virginia*, by Nancy Ross Hugo and Jeff Kirwan, Virginia Tech Professor of Forestry. In addition, research findings will be provided to all participants upon completion of the project.

Thanks in advance for your participation!

Sincerely,

Amy D. Jahnke
Graduate Research Assistant
Virginia Tech
Department of Wood Science and Forest Products
230 Cheatham Hall (0323)
Blacksburg, VA 24061
adjahnke@vt.edu
540-808-3572

Questions Posed in Online Survey

The purpose of this survey is to help your company and the hardwood veneer industry better understand the factors that impact innovativeness in the industry. Current business models show that innovative firms are more competitive and profitable in their market segments. The results of this study will provide insight into the innovation tendencies of the veneer industry and the factors that may be barriers to innovation. By taking a few minutes to complete this survey, you will be greatly helping both the veneer industry and me with my graduate research project at Virginia Tech!

1. Which of the following options best describes your firm?

Veneer trader
Custom slicer

Veneer manufacturer, single facility
Veneer manufacturer, multiple facilities, single country
Veneer manufacturer, multiple facilities, multi-national
Veneer department of corporation
other:

2. How long has your firm been in business?

0-9 years
10-29 years
30-49 years
50-69 years
70-89 years
90 or more years

3. Which geographic region best describes your firm's location? (If your firm has more than one location, which region best describes where the headquarters or main facility is located?)

The Ruhr
Other parts of Germany
Austria
Other

How strongly do you agree or disagree with the following statement?

4. My firm is innovative
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

5. Which of the following statements best describes how your firm uses its resources (i.e., suppliers, production capabilities, human capital, etc.) to serve customers?

We use existing resources to serve our existing markets

We use existing resource to serve new markets

We create new resources to serve our existing markets

We create new resources to serve new markets

QUESTIONS 6-10: Please indicate how strongly you disagree or agree with each of the following statements:

6. It is a goal of my firm to find and use new sources of raw materials or partially-manufactured goods.

(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

7. It is a goal of my firm to develop and introduce new production or material-flow methods.

(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

8. It is a goal of my firm to create OR enter new markets, including new geographic regions or new applications for veneer.

(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

9. It is a goal of my firm to develop and offer new kinds or qualities of products or services to our customers.

(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

10. It is a goal of my firm to identify new business models and reorganize in a way that creates value.

(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

11. Which of the following items has your firm largely accomplished? (Check all that apply.)
Identified and used new sources of raw materials or half-manufactured goods
Developed and introduced production or material-flow methods new to the veneer industry
Created OR entered new markets (i.e., geographic regions or new applications for veneer)
Developed and offered new kinds or qualities of products or services to customers
Identified a new business model and reorganized the firm in a way that created value

SOURCES OF SUPPLY

QUESTIONS 12-21: Please indicate how strongly you disagree or agree that each of the following factors impacts how your firm finds and uses new sources of supply of raw materials or partially-manufactured goods.

12. Language is a barrier in raw material procurement negotiations.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

13. Certified raw materials are easy to find.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

14. All of the raw materials my firm needs to serve our customers are readily available.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

15. Consumer expectations for raw material quality are high.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

16. Exchange rate changes often force my firm to alter where raw materials are sourced.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

17. Advances in supply chain technology have not improved my firm's ability to identify and track new sources of supply.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

18. Export trade policies have aided domestic sourcing of raw materials.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

19. The European due diligence or 'FLEGT' legislation has created a trade barrier for my firm.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

20. Advances in veneer slicing technology have increased the range of log qualities my firm can purchase and produce.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

21. Domestic raw material supplies are affordable for my firm.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

Please use the following space for additional comments. Are there any other barriers to your firm's identification and use of new sources of supply of raw materials or partially-manufactured goods?

PRODUCTION METHODS

QUESTIONS 22-31: Please indicate how strongly you disagree or agree that each of the following factors impacts how your firm develops and introduces production or material-flow methods to the veneer industry.

22. Regulatory changes that tighten product standards are a barrier.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

23. Changes in products or markets to meet consumer demand have altered the production methods needed by my firm.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

24. Current open source slicing technology does not meet my firm's production needs.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

25. Lack of availability of capital has negatively impacted my firm's ability to improve its production methods.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

26. Current open source supply chain technology meets my firm's needs.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

27. The need for a safer working environment has caused my firm to improve its methods of production.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

28. Tax policies of the country that my firm operates in are a barrier for my firm to improve its production methods.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

29. Demographic changes in the workforce have improved my firm's production methods.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

30. Collaborations with educational institutions have improved my firm's production methods.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

31. Close proximity to competitor firms that supports knowledge transfer has improved my firm's production methods.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

Please use the following space for additional comments. Are there any other barriers to your firm's development and introduction of production or material-flow methods to the veneer industry?

MARKETS

QUESTIONS 32-41: Please indicate how strongly you disagree or agree that each of the following factors impacts how your firm creates OR enters new markets, including new geographic regions or new applications for veneer.

32. The global economic crisis has had a negative impact on my firm's ability to find or enter new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

33. Regional consumer product preferences do not allow my firm to enter new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

34. Technological advances outside the veneer industry have improved my firm's ability to find or enter new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

35. Currency exchange rates negatively impact my firm's entrance into new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

36. International marketing efforts of trade associations have aided new market development for my firm.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

37. The location of my firm's facilities no longer provides a competitive advantage for finding or entering new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

38. Cultural differences are a barrier for my firm's identification of or entrance into new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

39. Supply chain technology has helped my firm identify or enter new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

40. The small size of the European veneer industry does not improve my firm's ability to find or enter new markets.

(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

41. Current government policies aid my firm's efforts in finding or entering new markets.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

Please use the following space for additional comments. Are there any other barriers to your firm's creation OR entrance into new markets, including new geographic regions or new applications for veneer?

PRODUCTS AND SERVICES

QUESTIONS 42-51: Please indicate how strongly you disagree or agree that each of the following factors impacts how your firm develops and offers new kinds or qualities of products or services to your customers.

42. Consumer demands for product quality make it difficult for my firm to develop and offer new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

43. Cheaper, imported products on the market create an opportunity for my firm to develop and offer new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

44. New technologies have improved my firm's capability to develop and offer new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

45. My firm's location does not facilitate new product or service development.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

46. Current legislation regulating product sustainability is a barrier to development and offering of new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

47. Advancements to supply chain technology have not aided my firm's efforts to develop and offer new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

48. Changing demographics in various parts of the world have improved my firm's ability to develop new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

49. The current economic crisis has created opportunities to develop or offer new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

50. Tax policies of the country where my firm operates do not support my firm's efforts to develop and offer new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

51. Adoption of forest certification is a barrier to my firm's efforts to develop and offer new products or services.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

Please use the following space for additional comments. Are there any barriers to your firm's development and offering of new kinds or qualities of products or services to your customers?

BUSINESS MODELS

QUESTIONS 52-61: Please indicate how strongly you disagree or agree that each of the following factors impacts how your firm identifies new business models and reorganizes in a way that creates value.

52. The global economic crisis has not allowed my firm to reorganize in a way that is competitive.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

53. Ensuring worker safety enhances my firm's ability to generate value.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

54. Creation or adoption of new technologies has completely changed how my firm operates.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

55. Legal restrictions on lending have not allowed my firm to reorganize in a way that creates value.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

56. Adaptation to changes in consumer demand has created an opportunity for my firm to reorganize in a way that generates value.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

57. The implementation of forest certification has created a need to reorganize my firm in a way that creates value.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

58. The implementation of lean manufacturing has created an opportunity for my firm to create value through reorganization.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

59. Current regulations improve my firm's ability to create a competitive advantage in the global marketplace.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

60. Labor costs are a barrier to my firm's efforts to reorganize in a way that creates value.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

61. Supply chain technology has improved the way my firm is organized in a way that is competitive.
(1) Strongly disagree (2) Disagree (3) Neither (4) Agree (5) Strongly agree

Please use the following space for additional comments. Are there any other barriers to your firm's identification of new business models and reorganization in ways that create value?

GENERAL INFORMATION

When answering the following questions about your firm, please include information about all locations or facilities owned by your firm in your answer.

62. How many employees does your firm employ?

< 50

50-99

100-199

> 200

63. What is the value of veneer sales your firm makes annually (in EURO, where MM = millions)?

< €1MM

€1-4.9MM

€5-9.9MM

€10-19.9MM

€20-29.9MM

> €30MM

64. My firm is a member of the following trade associations (check all that apply):

Initiative Furnier + Natur e.V.

proHolz Austria

Hauptverband der Deutschen Holzindustrie (HDH)

Verband der Deutschen Möbilindustrie (VDM)

other, please specify:

65. My firm attends the following forest products industry trade shows (please check all that apply):

IWF-Atlanta (The International Woodworking Machinery & Furniture Supply Fair)

AWFS-Las Vegas (Association of Woodworking & Furnishings Suppliers Fair)

imm-Cologne (interzum)

interzum-Guangzhou

interzum-Moscow

LIGNA

other, please specify:

66. Which of the following options best describes your firm's international business presence?

We operate only in Austria/Germany

We operate in other countries, but our headquarters are in Austria/Germany

We operate in Austria/Germany, but our headquarters are in another country

67. How many patents does your firm hold for innovations in the hardwood veneer industry?

0

1

2

3 or more

68. Which of the following options best describes your job title with the firm?

CEO/President

Sales manager

Production manager

Procurement manager

Other manager

other, please specify:

69. What is your education level?

Less than high school

High school completion

Some college

College degree

Some graduate education

Graduate degree

other, please specify:

70. What is the greatest barrier to your firm's innovation?

Thank you for your participation!

Post-Survey Thank You E-mail

From: Amy D. Jahnke

Sent: Monday, November 8, 2010, 8AM

To: [Veneer company recipients]

Subject: Thank you!

Dear [personalized name],

Thank you very much for your time completing the Virginia Tech Veneer Survey. Your responses are very important to my research and the future of the hardwood veneer industry! Your name will be entered in a drawing for a wooden desktop clock or a hardcover edition of the book, *Remarkable Trees of Virginia*, by Nancy Ross Hugo and Jeff Kirwan, Virginia Tech Professor of Forestry. In addition, research findings will be provided to you upon completion of the project.

Thanks again for your help!

Sincerely,

Amy D. Jahnke
Graduate Research Assistant
Virginia Tech
Department of Wood Science and Forest Products
230 Cheatham Hall (0323)
Blacksburg, VA 24061
adjahnke@vt.edu
540-808-3572

Appendix F. Survey Correspondence and Questionnaire (in German)

Pre-Survey E-mail

From: Amy D. Jahnke

Sent: Monday @ 8AM

To: [Veneer company recipients]

Subject: Virginia Tech Furnier Befragung

Sehr geehrter/e [Herr/Frau Vor- und Nachname],

Nächsten Montag werden Sie eine Einladung erhalten, an einer Befragung über Innovationen in der Furnierindustrie teilzunehmen. Der Zweck dieser Befragung ist es Ihnen, als auch der Furnierindustrie, zu helfen, die Faktoren, die auf die Innovationskraft der Furnierindustrie einwirken, zu verstehen. Derzeitige Geschäftsmodelle zeigen, dass innovative Firmen in ihren jeweiligen Marktsegmenten wettbewerbsfähiger und gewinnbringender als ihre Konkurrenten sind. Die Untersuchungsergebnisse werden Einblick in die Innovationstendenzen der Furnierindustrie erlauben und Faktoren identifizieren, die Innovationen im Weg stehen.

Durch die Teilnahme an dieser Befragung würden Sie der Furnierindustrie und meinem Forschungsprojekt an der Virginia Tech sehr helfen! Zusaetzlich berechtigt Sie Ihre Mitarbeit, an einer Lotterie im Februar teilzunehmen.

Ich hoffe Sie entschliessen sich dazu an unserer Befragung teilzunehmen!

Mit freundlichen Grüssen,

Amy D. Jahnke
Doktorand
Virginia Tech
Fachbereich fuer Holzwissenschaften (Department of Wood Science and Forest Products)
230 Cheatham Hall (0323)
Blacksburg, VA 24061
adjahnke@vt.edu
540-808-3572

Survey Invitation E-mail

From: Amy D. Jahnke

Sent: Monday @ 8AM after Pre-survey e-mail

To: [Veneer company recipients]

Subject: Einladung zur Virginia Tech Furnier Befragung

Sehr geehrter/e Herr oder Frau bei ,

Wie Ihnen sicher bewusst ist, hat sich der Rückgang der Ökonomie dramatisch auf die Laubholzfurnierindustrie ausgewirkt. Ein Weg, wie Firmen im 21. Jahrhundert wettbewerbsfähiger sein können, ist innovativer zu sein, eine Eigenschaft die der Holzindustrie nicht oft nachgesagt wird. Das Ziel dieses Untersuchung ist es, sowohl die Innovationstendenzen von Firmen, als auch die Einflüsse der Furnierindustrie an die Wettbewerbsfähigkeit der Firmen zu verstehen. Ich bitte um Ihre Hilfe, die Gründe für den Innovationsmangel in der Industrie zu verstehen und Lösungsmöglichkeiten anzubieten.

Sie wurden als Mitglied der Europaischen Furnierindustrie ausgewählt, an dieser Befragung bezüglich der Innovationstendenzen Ihrer Firma teilzunehmen. Da die Zahl von Laubholzfurnierfirmen beschränkt ist, ist Ihre Teilnehme zum Erfolg der Befragung entscheidend. Die Untersuchungsergebnisse sollen Ihrer Firme und der Furnierindustrie helfen, die Bereiche in denen sich Innovativität bezahlt machen können zu identifizieren. Die Befragung dauert ca. 20 Minuten.

Ich würde sehr zuschätzen wissen, wenn Sie sich die Zeit nehmen könnten, die Furnierbefragung auszufüllen. Bitte kopieren Sie den folgenden Link in Ihren Webbrowser, und nutzen Sie Ihren 5-zahliger Zugangsschlüssel um sich einzuloggen:

Befragung-Auf Deutsch

https://survey.vt.edu/survey/entry.jsp?id=1296325307413

Befragung-Auf Englisch

https://survey.vt.edu/survey/entry.jsp?id=1296432693368

Zugangsschlüssel: ***** (String of 5 digits unique to each company)

Ihre Antworten werden vertraulich behandelt und Ihre Teilnahme der Befragung ist freiwillig. Wenn Sie eine Frage nicht beantworten möchten, lassen Sie sie aus und setzten die Befragung mit der nächsten Frage fort. Dieses Forschungsprojekt wird von die Virginia Tech Institutional Review Board geprüft und anerkannt. Wenn Sie Fragen über Ihre Teilnehmerrechte haben, bitte kontaktieren sie Dr. David M. Moore unter 001-540-231-4991 oder via email an moored@vt.edu. Wenn Sie weitere Fragen oder Kommentare bezüglich diese Untersuchung haben, bitte kontaktieren Sich mich (sie untern für Kontaktinformationen) oder Dr. Bob Smith, unter 001- 540-231-7679 oder rsmith4@vt.edu.

Nach Beendigung Ihrer Befragung, nehmen Sie automatisch an einer Verlosung teil, bei der sie eine Schreibtischplatten Uhr aus Holz oder ein gebundenes Buch, *Remarkable Trees of Virginia*, bei Nancy Ross Hugo and Jeff Kirwan, Virginia Tech Forstwissenschaftsprofessor, gewinnen können. Zusätzlich, nach Projektsabschluss, werden die Untersuchungsergebnisse an alle Teilnehmern ausgegeben.

Vielen Dank im Voraus für Ihre Mitarbeit!

Mit freundlichen Grüssen,

Amy D. Jahnke
Doktorand
Virginia Tech
Fachbereich für Holzwissenschaften (Department of Wood Science and Forest Products)
230 Cheatham Hall (0323)
Blacksburg, VA 24061
adjahnke@vt.edu
540-808-3572

Questions Posed in Online Survey

Der Zweck dieser Befragung ist es Ihnen als Unternehmen, sowie auch der Furnierindustrie, zu helfen, die Faktoren, die auf die Innovationskraft der Furnierindustrie einwirken, zu verstehen. Derzeitige Geschäftsmodelle zeigen, dass innovative Firmen in ihren jeweiligen Marktsegmenten wettbewerbsfähiger und gewinnbringender als ihre Konkurrenten sind. Die Untersuchungsergebnisse werden Einblick in die Innovationstendenzen der Furnierindustrie erlauben und die Faktoren identifizieren, die Innovationen im Weg stehen. Durch die Teilnahme an dieser Befragung würden Sie der Furnierindustrie und meinem Forschungsprojekt an der Virginia Tech sehr helfen!

1. Welche der folgenden Begriffe beschreibt Ihr Unternehmen am besten?
Furnierhändler
Lohnmesserer
Furnierhersteller, mit einzelner Anlage
Furnierhersteller, mehrere Anlagen, einzelnes Land
Furnierhersteller, mehrere Anlagen, mehrere Länder
Furnierabteilung einer Aktiensgesellschaft
Andere:

2. Wie lange besteht Ihr Unternehmen schon?
0-9 Jahre
10-29 Jahre
30-49 Jahre
50-69 Jahre
70-89 Jahre
90 oder mehr Jahre

3. In welcher geographischen Region befindet sich der Sitz Ihres Unternehmens? (Wenn Ihr Unternehmen mehre Niederlassungen hat, wo befindet sich Ihr Hauptsitz?)
Das Ruhrgebiet
Anderer Teil Deutschlands

Österreich
Andere

Wie fest widersprechen oder stimmen Sie den folgenden Äusserung zu?
4. Mein Unternehmen ist innovativ
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

5. Welche der folgenden Äußerungen beschreibt den Ressourcengebrauch Ihres Unternehmens am besten (z.B. Lieferanten, Einsatzmöglichkeiten der Herstellung, Einsatzmöglichkeiten den Menschen, etc.)?
Wir nutzen bestehende Ressourcen um bestehende Märkte zu bedienen
Wir nutzen bestehende Ressourcen um neue Märkte zu bedienen
Wir schaffen neue Ressourcen um bestehende Märkte zu bedienen
Wir schaffen neue Ressourcen um neue Märkte zu bedienen

FRAGEN 6-10: Bitte wählen Sie wie sehr Sie den folgenden Äußerungen widersprechen oder zustimmen:

6. Ein Ziel meines Unternehmens ist es, neue Quellen von Rohstoffen oder Halbzeug zu finden und zu nutzen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

7. Ein Ziel meines Unternehmens ist es, neue Produktionsmethoden oder Materialflussmethoden zu entwickeln und einzuführen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

8. Ein Ziel meines Unternehmens ist es, neue Märkte, inklusive neuer geographischer Regionen oder neuer Furnieranwendungen, zu kreieren ODER in existierende Märkte zu expandieren.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

9. Ein Ziel meines Unternehmens ist es, neue Qualitäten von Produkten oder Dienstleistungen zu entwickeln und den Kunden anzubieten.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

10. Ein Ziel meines Unternehmen ist es, neue Geschäftsmodelle zu finden, und ihren Wert durch Neugestaltungen, zu erschöpfen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

11. Welche der folgenden Elemente hat Ihr Unternehmen im grossen Teil durchgesetzt? (Alle zutreffenden Antworten ankreuzen.)
Neue Quellen von Rohstoffen oder Halbzeugen identifizieren und nutzen
Produktions- oder Materielflussmethoden neu für die Furnierindustries entwickeln und einführen
Neue Märkte (bzw. geographische Regionen oder neue Furnieranwendungen) kreieren ODER daran teilnehmen.
Neue Arten oder Qualitäten von Produkten oder Dienstleistungen entwickeln und den Kunden anbieten
Neue Geschäftsmodelle identifizieren und ihren Wert durch Neugestaltungen erschöpfen.

ANLIEFERUNGSQUELLEN

FRAGEN 12-21: Bitte wählen Sie für Ihr Unternehmen, wie sehr die folgenden Faktoren zur Findung und Nutzung von neuen Quellen von Rohstoffen oder Halbzeugen beigetragen haben:

12. Die Sprache ist während Verhandlungsgesprächen ein Hindernis.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

13. Zertifizierte Rohstoffe sind einfach zu finden.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

14. Rohstoffe, die notwendig sind um den Kunden zu bedienen, sind für mein Unternehmen in der Regel verfügbar.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

15. Die Erwartungen der Konsumenten an die Rohstoffqualität sind hoch.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

16. Veränderungen der Wechselkurse nötigen mein Unternehmen oft ihre Rohstoffquellen zu ändern.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

17. Fortschritte in der Technologie der Zulieferkettes haben mein Unternehmen nicht geholfen neue Quellen zu identifizieren und verfolgen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

18. Exportgeschäftpolicen haben die inländische Rohstuffsbeschaffung gefördert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

19. Die Europäische 'Sorgfaltspflicht' oder FLEGT Recht hat ein Handelshindernis für mein Unternehmen geschaffen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

20. Technologiefortschritte des Furnierschneidens haben die Auswahl an Stammqualitäten die meinem Unternehmen einkaufen und produzieren kann, vergrössert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

21. Inländischen Rohstoffquellen sind für mein Unternehmen bezahlbar.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

Bitte nutzen Sie das folgende Leerfeld, um zusätzliche Kommentare einzugeben. Gibt es anderen Faktoren die die Identifizierung und Nutzung von neuen Anlieferquellen für Rohstoffe oder Halbzeuge behindern?

PRODUKTIONSMETHODE

FRAGEN 22-31: Bitte wählen Sie für Ihr Unternehmen, wie sehr die folgenden Faktoren die Entwicklung und Einführung von neuen Produktions- oder Materialflussmethoden in der Furnierindustrie beeinflussen:

22. Behördliche Änderungen, welche die Produktanforderungen verstärken, sind ein Hindernis.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

23. Produkt- oder Marktänderungen, um Kundenwünsche zu erfüllen, haben die notwendigen Produktionsmethoden meines Unternehmens geändert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

24. Derzeitig frei erhältliche Schnittechnologien erfüllen die Produktionsanforderungen meines Unternehmens nicht.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

25. Mangelnde Kapitalverfügbarkeit hat das Vermögen meines Unternehmens die Produktionsmethoden zu verbessern, negativ beeinflusst.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

26. Derzeitig frei erhältliche Lieferkettentechnologien erfüllen die Bedürfnisse meines Unternehmens.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

27. Das Bedürfnis für eines sicherern Arbeitsumfelds hat mein Unternehmen dazu gebracht ihren Produktionsmethoden zu verbessern.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

28. Die Steuerpolitik des Landes ist für mein Unternehmen ein Hindernis, ihre Produktionsmethoden zu verbessern.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

29. Demographische Änderungen der Arbeitskräfte haben die Produktionsmethoden meines Unternehmens verbessert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

30. Zusammenarbeiten mit Bildungseinrichtungen haben die Produktionsmethoden meines Unternehmens verbessert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

31. Die Lage von Konkurrenzfirmen, die den Wissentransfer unterstützt, hat die Produktionsmethoden meines Unternehmens verbessert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

Bitte nutzen Sie das folgende Leerfeld, um zusätzliche Kommentare einzugeben. Gibt es anderen Hindernisse für die Entwicklung und Einführung von neuen Produktions- oder Materialflussmethoden der Furnierindustries für Ihr Unternehmen?

MÄRKTE

FRAGEN 32-41: Bitte wählen Sie für Ihr Unternehmen, wie sehr die folgenden Faktoren, die Kreirung ODER Teilnahme an neuen Märkten, inklusive neuer geographischen Regionen und neuer Furnieranwendungen beeinflussen:

32. Die globale Wirtschaftskrise hat die Fähigkeit meines Unternehmens neue Märkte zu identifizieren oder an ihnen teilzunehmen negativ beeinflusst.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

33. Regionale Kundenpräferenzen der Produkte haben es meinem Unternehmen nicht erlaubt neuen Märkte zu betreten.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

34. Technologische Fortschritte außerhalb der Furnierindustrie haben das Vermögen meines Unternehmens neuen Märkte zu identifizieren oder an ihnen teilzunehmen verbessert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

35. Der Währungskurs wirkt sich negativ auf den Eintritt meines Unternehmens in neue Märkte aus.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

36. Internationale Marktbemühungen von Fachverbänden haben neue Marktentwicklungen meines Unternehmens gefördert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

37. Die Lage meiner Betriebsanlagen bildet keinen Wettbewerbsvorteil mehr um neue Märkte zu finden oder an ihnen teilzunehmen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

38. Kulturelle Unterschiede sind für die Identifizierung oder den Eintritt in neue Märkte ein Hindernis meinem Unternehmen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

39. Lieferkettentechnologien haben mein Unternehmen geholfen neue Märkte zu identifizieren oder an ihnen teilzunehmen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

40. Die eingeschränkte Grösse der Europäischen Furnierindustries verbessert die Fähigkeit meines Unternehmens neue Märkte zu finden oder an ihnen teilzunehmen nicht.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

41. Derzeitige Regierungspolicen helfen der Bemühungen meines Unternehmens, neue Märkte zu finden oder an ihnen teilzunehmen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

Bitte nutzen Sie das folgende Leerfeld, um zusätzliche Kommentare einzugeben. Gibt es anderen Hindernisse für die Erschaffung oder Realisierung von neue Märkten, inklusiv neuer geographische Regionen oder neuer Furnieranwendungen?

PRODUKTE UND DIENSTLEISTUNGEN

FRAGEN 42-51: Bitte wählen Sie für Ihr Unternehmen, wie sehr die folgenden Faktoren die Entwicklung und das Angebot neuer Arten oder Qualitäten für Produkte oder Dienstleistungen an ihre Kunden beeinflussen:

42. Ansprüche von Konsumenten an Produktqualität machen die Entwicklung und das Angebot von Produkten oder Dienstleistungen für mein Unternehmen schwierig.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

43. Preisgünstigere, importierte Produkte auf dem Markt eröffnen meinem Unternehmen eine Gelegenheit neue Produkte oder Dienstleistungen zu entwickeln und anzubieten.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

44. Neue Technologien haben die Fähigkeit meines Unternehmens neuen Produkte oder Dienstleistungen zu entwickeln und anzubieten gefördert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

45. Der Standort meines Unternehmens fördert die Entwicklung von neuer Produkte oder Dienstleistungen nicht.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

46. Die derzeitige Gesetzgebung, die die Produktnachhaltigkeit regeln, ist ein Hindernis für die Entwicklung und das Angebot von neuen Produkte oder Dienstleistungen für mein Unternehmen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

47. Fortschritte in der Lieferkettentechnologie haben den Bemühungen meines Unternehmens nicht geholfen neue Produkte oder Dienstleistungen zu entwickeln und anzubieten.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

48. Demographische Änderungen in verschiedenen Teilen der Welt haben die Fähigkeit meines Unternehmens neue Produkte oder Dienstleistungen zu entwickeln verbessert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

49. Die derzeitige Wirtschaftskrise hat Möglichkeiten für die Entwicklung neuer Produkte oder Dienstleistungen geschaffen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

50. Die Steuerpolitik des Landes sichert die Bemühungen meines Unternehmens neue Produkte und Dienstleistungen zu entwickeln und anzubieten nicht.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

51. Die Einführung von Forstzertifizierungen ist ein Hindernis für die Bemühungen meines Unternehmens neue Produkte und Dienstleistungen zu entwickeln und anzubieten.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

Bitte nutzen Sie das folgende Leerfeld, um zusätzliche Kommentare einzugeben. Gibt es anderen Hindernisse für die Entwicklung und das Angebot neuer Arten oder Qualitäten von Produkten oder Dienstleistungen für Ihr Unternehmen?

GESCHÄFTSMODELLE

FRAGEN 52-61: Bitte wählen Sie für Ihr Unternehmen, wie sehr die folgenden Faktoren die Identifizierung von neuen Geschäftsmodellen, als auch die Umstrukturierung Ihres Unternehmens um Wert zu schöpfen beeinflussen:

52. Die globale Wirschaftskrise hat es meinem Unternehmen nicht erlaubt sich neu zu organisieren um ihre Wettbewerbsfähigkeit zu sichern.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

53. Die Wahrung der Arbeitssicherheit steigert die Fähigkeit meines Unternehmens einen neuen Wert zu schöpfen.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

54. Die Schöpfung oder Einführung von neuen Technologien hat die Art und wie mein Unternehmen arbeitet vollständig verändert.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

55. Rechtliche Beschränkungen im Kreditwesen haben es meinem Unternehmen nicht ermöglicht sich so umzustrukturieren, dass Wert geschöpft wird.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

56. Die Anpassung an Änderungen von Konsumentenansprüchen, hat eine Möglichkeit für mein Unternehmen geschaffen, sich umzuorganizieren, sodass neuer Wert geschöpft werden kann.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

57. Die Einführung von Forstzertifizierung hat einen Bedarf geschaffen mein Unternehmen umzuorganizieren, sodass Wert geschöpft werden kann.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

58. Die Anwendung von 'Schlanke Produktion' hat eine Möglichkeit geschaffen sodass mein Unternehmen durch Umorganisierung Wert schöpfen kann.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

59. Derzeitiger Rechtsvorschriften verbessern die Fähigkeit meines Unternehmens sich einen Wettbewerbsvorteil im globalen Markt zu sichern.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

60. Arbeitskosten sind für die Umorganisierung meines Unternehmens um ihre Wertschöpfung zu sichern ein Hindernis.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

61. Lieferkettentechnologie hat die Organisation meines Unternehmens verbessert, sodass sie wettbewerbsfähig ist.
(1) Starker Widerspruch (2) Widerspruch (3) keine Meinung (4) Zustimmung (5) Starke Zustimmung

Bitte nutzen Sie das folgende Leerfeld, um zusätzliche Kommentare einzugeben. Gibt es anderen Hindernisse für die Identifizierung von neuen Geschäftsmodellen und die Umorganisierung ihres Unternehmens um ihre Wertschöpfung zu sichern?

ALLGEMEINE ANGABEN

Wenn Sie die folgenden Fragen beantworten, bitte berücksichtigen sie alle Niederlassungen oder Betriebsanlagen Ihres Unternehmens.

62. Wieviele Mitarbeiter beschäftigt Ihr Unternehmen?
< 50
50-99
100-199
> 200

63. Wie hoch ist der Wert des Furniers, dass Ihr Unternehmen jedes Jahr verkauft (in Euro, wo MM = Millionen)?
< €1MM
€1-4.9MM
€5-9.9MM
€10-19.9MM
€20-29.9MM
> €30MM

64. Mein Unternehmen ist ein Mitglieder der folgenden Fachverbände (alle zutreffende Antworten ankreuzen):
Initiative Furnier + Natur e.V.
proHolz Austria
Hauptverband der Deutschen Holzindustrie (HDH)
Verband der Deutschen Möbilindustrie (VDM)
Anderen, bitte auflisten:

65. Mein Unternehmen nimmt an den folgenden Messen teil (alle zutreffende Antworten ankreuzen):
IWF-Atlanta (The International Woodworking Machinery & Furniture Supply Fair)
AWFS-Las Vegas (Association of Woodworking & Furnishings Suppliers Fair)
imm-Cologne (interzum)
interzum-Guangzhou
interzum-Moscow
LIGNA
Anderen, bitte auflisten:

66. Welche der folgenden Möglichkeiten beschreibt die internationale Präsenz Ihres Unternehmens am besten?
Wir arbeiten nur in Österreich/Deutschland
Wir arbeiten in anderen Länder, aber unser Hauptsitz ist in Österreich/Deutschland
Wir arbeiten in Österreich/Deutschland, aber unser Hauptsitz ist in einem anderen Land

67. Wieviele Patente besitzt Ihr Unternehmen für Innovationen in der Laubholzfurnierindustrie?
0
1
2
3 oder mehr

68. Welche der folgenden Möglichkeiten beschreibt Ihre Position bei dem Unternehmen am besten?
CEO/Präsident
Verkaufsleiter
Produktionsleiter
Einkäufer
Anderer Leiter
Andere, bitte auflisten:

69. Was ist Ihre höchste abgeschlossene Ausbildung?

Kein Schulabschluss

Realschulabschluss

Hauptschulabschluss

Abitur

Hochschulerfahrung (kein Abschluss)

Hochschulabsolvent

Magister

Doktor

Diplom

Bachelor

Master

Anderen, bitte auflisten:

70. Was ist das grösste Hindernis für Innovationen Ihrem Unternehmen?

Vielen Dank für Ihre Teilnahme!

Post-Survey Thank You E-mail

From: Amy D. Jahnke
Sent: Monday, November 8, 2010, 8AM
To: [Veneer company recipients]
Subject: Vielen Dank!

Sehr geehrter/e Herr oder Frau bei,

Vielen dank dass Sie sich die Zeit genommen haben an der Virginia Tech Furnierbefragung teilzunehmen. Ihre Antworten sind sehr wichtig für meine Untersuchung und für die Zukunft der Laubholzfurnierindustrie! Durch Ihre Teilnahme an der Befragung nehmen sie automatisch auch an einer Verlosung teil, bei der sie eine Schreibtischplatten Uhr aus Holz oder ein gebundenes Buch, *Remarkable Trees of Virginia*, bei Nancy Ross Hugo and Jeff Kirwan, Virginia Tech Forstwissenschaftsprofessor, gewinnen können. Zusaetzlich, nach Projektsabschluss, werden die Untersuchungsergebnisse an alle Teilnehmern ausgegeben. Vielen Dank für Ihre Teilnahme!

Mit freundlichen Grüssen,

Amy D. Jahnke
Doktorand
Virginia Tech
Fachbereich fuer Holzwissenschaften (Department of Wood Science and Forest Products)
230 Cheatham Hall (0323)
Blacksburg, VA 24061
adjahnke@vt.edu
540-808-3572

Appendix G. Number of Acres of Certified Forest Lands under Three Popular Certification Schemes

Certification Scheme	United States	Austria/Germany	Globally
FSC[1]	33,811,313	949,932	354,101,615
PEFC[2]	83,987,493	22,832,871	579,067,775
SFI[1]	58,052,719	NA	189,496,924

[1]Data accurate as of July 2011

[2]Data accurate as of June 2011

Appendix H. Impacts on Innovation Areas from External Environmental Factors

Scale Name	*Impact and Survey Item*
SS*SOC	**Social * Sources of Supply** a) Language is a facilitator in raw material procurement negotiations b) Consumer expectations for raw material quality are high
PM*SOC	**Social * Production Methods** a) The need for a safer working environment has caused my firm to improve its methods of production b) Demographic changes in the workforce have improved my firm's production methods
MA*SOC	**Social * Markets** a) Regional consumer product preferences allow my firm to enter new markets b) Cultural differences facilitate my firm's identification of or entrance into new markets
PS*SOC	**Social * Products and Services** a) Consumers demands for product quality make it easier for my firm to develop and offer new products or services b) Changing demographics in various parts of the world have improved my firm's ability to develop new products or services
BM*SOC	**Social * Business Models** a) Ensuring worker safety enhances my firm's ability to generate value b) Adaptation to changes in consumer demand has created an opportunity for my firm to reorganize in a way that generates value
SS*TECH	**Technological * Sources of Supply** a) Advances in supply chain technology have improved my firm's ability to identify and track new sources of supply b) Advances in veneer slicing technology have increased the range of log qualities my firm can purchase and produce
PM*TECH	**Technological * Production Methods** a) Current open source slicing technology meets my firm's production needs b) Current open source supply chain technology meets my firm's needs
MA*TECH	**Technological * Markets** a) Supply chain technology has helped my firm identify or enter new markets b) Technological advances outside the veneer industry have improved my firm's ability to find or enter new markets
PS*TECH	**Technological * Products and Services** a) New technologies have improved my firm's capability to develop and offer new products or services b) Advancements to supply chain technology have aided my firm's efforts to develop and offer new products or services
BM*TECH	**Technological * Business Models** a) Creation or adoption of new technologies has completely changed how my firm operates b) Supply chain technology has improved the way my firm is organized in a way that is competitive

Scale Name	*Impact and Survey Item*
SS*ECOL	**Ecological * Sources of Supply** a) Certified raw materials are easy to find b) All of the raw materials my firm needs to serve our customers are readily available
PM*ECOL	**Ecological * Production Methods** a) Changes in products or markets to meet consumer demand have altered the production methods needed by my firm b) Close proximity to competitor firms that supports knowledge transfer has improved my firm's production methods
MA*ECOL	**Ecological * Markets** a) The location of my firm's facilities provides a competitive advantage for finding or entering new markets b) The small size of the US veneer industry improves my firm's ability to find or enter new markets
PS*ECOL	**Ecological * Products and Services** a) My firm's location facilitates new product or service development b) Adoption of forest certification is a facilitator to my firm's efforts to develop and offer new products or services
BM*ECOL	**Ecological * Business Models** a) The implementation of forest certification has created a need to reorganize my firm in a way that creates value b) The implementation of lean manufacturing has created an opportunity for my firm to create value through reorganization
SS*ECON	**Economic* Sources of Supply** a) Exchange rate changes often aid my firm in sourcing raw materials b) Domestic raw material supplies are affordable for my firm
PM*ECON	**Economic * Production Methods** a) Lack of availability of capital has positively impacted my firm's ability to improve its production methods b) Collaborations with educational institutions have improved my firm's production methods
MA*ECON	**Economic * Markets** a) The global economic crisis has had a positive impact on my firm's ability to find or enter new markets b) Currency exchange rates positively impact my firm's entrance into new markets
PS*ECON	**Economic * Products and Services** a) Cheaper, imported products on the market create an opportunity for my firm to develop and offer new products or services b) The current economic crisis has created opportunities to develop or offer new products or services

Scale Name	*Impact and Survey Item*
BM*ECON	**Economic * Business Models** a) The global economic crisis has allowed my firm to reorganize in a way that is competitive b) Labor costs are a barrier to my firm's efforts to reorganize in a way that creates value
SS*POL	**Political * Sources of Supply** a) Export trade policies have aided domestic sourcing of raw materials b) The Lacey Act has enabled trade for my firm
PM*POL	**Political * Production Methods** a) Regulatory changes that tighten product standards are not a barrier b) Federal tax policies aid my firm in improving its production methods
MA*POL	**Political * Markets** a) International marketing efforts of trade associations have aided new market development for my firm b) Current government policies aid my firm's efforts in finding or entering new markets
PS*POL	**Political * Products and Services** a) Current legislation regulating product sustainability facilitates development and offering of new products or services b) Federal tax policies support my firm's efforts to develop and offer new products or services
BM*POL	**Political * Business Models** a) Legal restrictions on lending have allowed my firm to reorganize in a way that creates value b) Current regulations improve my firm's ability to create a competitive advantage in the global marketplace

Appendix I. Results from Shapiro-Wilk W Test for Normality

Question	Question 1		Question 2	
	Shapiro-Wilk W statistic	**p-value**	**Shapiro-Wilk W statistic**	**p-value**
Sources of Supply				
Social	0.8377	< 0.0001	0.7778	< 0.0001
Technological	0.8886	< 0.0001	0.8815	< 0.0001
Economic	0.9086	0.0004	0.8823	< 0.0001
Ecological	0.8850	< 0.0001	0.8433	< 0.0001
Political	0.8397	< 0.0001	0.8784	< 0.0001
Methods of Production				
Social	0.8572	< 0.0001	0.8674	< 0.0001
Technological	0.8288	< 0.0001	0.7847	< 0.0001
Economic	0.9052	0.0003	0.8711	< 0.0001
Ecological	0.8362	< 0.0001	0.8385	< 0.0001
Political	0.8969	< 0.0001	0.8628	< 0.0001
Markets				
Social	0.8817	< 0.0001	0.9028	0.0003
Technological	0.8815	< 0.0001	0.8662	< 0.0001
Economic	0.8538	< 0.0001	0.8706	< 0.0001
Ecological	0.8922	< 0.0001	0.8726	< 0.0001
Political	0.8733	< 0.0001	0.8741	< 0.0001
Products and Services	0.8626	< 0.0001	0.8922	0.0001
Social	0.8826	< 0.0001	0.8308	< 0.0001
Technological	0.8916	< 0.0001	0.8748	< 0.0001
Economic	0.8777	< 0.0001	0.8768	< 0.0001
Ecological	0.9115	0.0005	0.8393	< 0.0001
Political				
Business Models				
Social	0.7954	< 0.0001	0.8235	< 0.0001
Technological	0.8850	< 0.0001	0.7859	< 0.0001
Economic	0.8931	< 0.0001	0.8431	< 0.0001
Ecological	0.8968	0.0001	0.8714	< 0.0001
Political	0.8608	< 0.0001	0.8261	< 0.0001

Appendix J. Means and Standard Deviation Results on Survey Response Data used in Cohen's d Test of Effect Size Calculations

Austrian/German Survey Response Data

		Supply Sources	Production Methods	Markets	Products/ Services	Business Models	Grand Means
Political	Mean	2.86	2.45	1.98	2.44	2.52	**2.45**
	(St. Dev)	(1.12)	(0.99)	(1.12)	(1.10)	(1.15)	**(0.31)**
Economic	Mean	3.13	2.84	2.81	2.53	2.63	**2.79**
	(St. Dev)	(1.06)	(1.17)	(1.24)	(1.13)	(1.11)	**(0.23)**
Social	Mean	2.88	2.84	3.09	2.77	2.55	**2.83**
	(St. Dev)	(1.19)	(1.13)	(1.41)	(1.18)	(1.10)	**(0.20)**
Technological	Mean	2.70	2.92	2.36	2.59	2.52	**2.62**
	(St. Dev)	(0.93)	(1.17)	(1.08)	(1.04)	(1.13)	**(0.21)**
Ecological	Mean	2.75	2.70	2.41	2.55	2.41	**2.56**
	(St. Dev)	(1.03)	(1.40)	(1.21)	(1.17)	(1.10)	**(0.16)**
Grand	**Mean**	**2.86**	**2.75**	**2.53**	**2.58**	**2.52**	**2.65**
	(St. Dev)	**(0.16)**	**(0.19)**	**(0.43)**	**(0.12)**	**(0.08)**	**(0.15)**

United States Survey Response Data

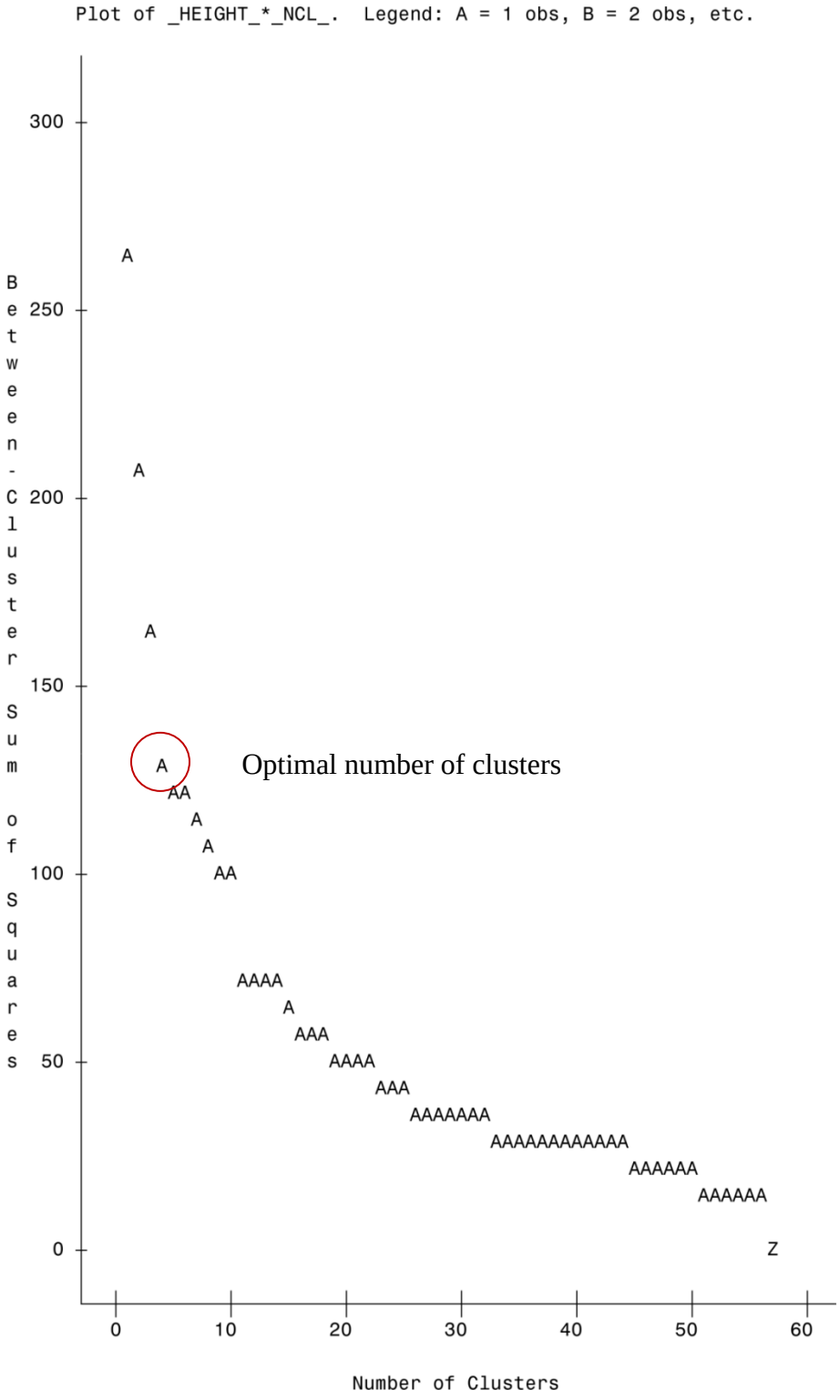
		Supply Sources	Production Methods	Markets	Products/ Services	Business Models	Grand Means
Political	Mean	2.72	2.88	2.61	2.63	2.77	**2.72**
	(St. Dev)	(0.77)	(0.82)	(0.95)	(0.80)	(0.78)	**(0.11)**
Economic	Mean	2.81	2.94	2.48	2.38	2.72	**2.67**
	(St. Dev)	(0.84)	(0.80)	(0.77)	(0.93)	(0.83)	**(0.23)**
Social	Mean	2.75	3.03	3.14	2.92	3.20	**3.01**
	(St. Dev)	(0.66)	(0.72)	(0.96)	(0.77)	(0.74)	**(0.18)**
Technological	Mean	2.61	3.25	2.95	2.89	2.95	**2.93**
	(St. Dev)	(0.77)	(0.79)	(0.77)	(0.79)	(0.79)	**(0.23)**
Ecological	Mean	2.33	3.20	3.09	3.09	3.14	**2.97**
	(St. Dev)	(0.87)	(0.81)	(1.01)	(0.90)	(0.87)	**(0.36)**
Grand	**Mean**	**2.64**	**3.06**	**2.86**	**2.78**	**2.96**	**2.86**
	(St. Dev)	**(0.19)**	**(0.16)**	**(0.29)**	**(0.28)**	**(0.22)**	**(0.16)**

Combined (Austrian/German and United States) Survey Response Data

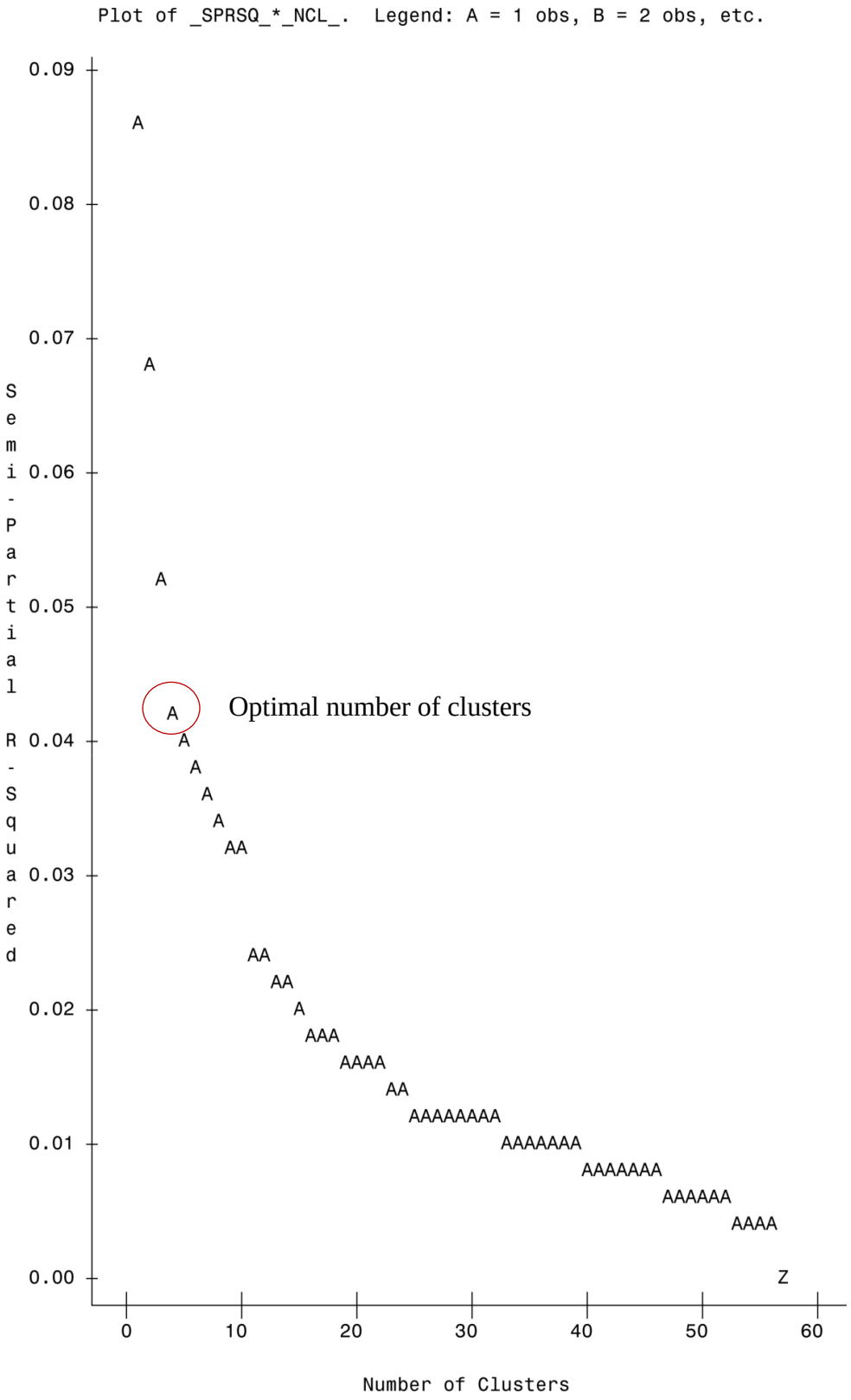
		Supply Sources	**Production Methods**	**Markets**	**Products/ Services**	**Business Models**	**Grand Means**
Political	Mean	2.88	2.75	2.37	2.61	2.73	**2.67**
	(St. Dev)	(0.83)	(0.81)	(1.01)	(0.86)	(0.87)	**(0.19)**
Economic	Mean	3.06	2.98	2.73	2.53	2.76	**2.81**
	(St. Dev)	(0.81)	(0.86)	(0.94)	(0.94)	(0.86)	**(0.21)**
Social	Mean	2.90	3.03	3.22	2.94	2.97	**3.01**
	(St. Dev)	(0.82)	(0.79)	(1.07)	(0.86)	(0.85)	**(0.12)**
Technological	Mean	2.74	3.19	2.74	2.83	2.82	**2.86**
	(St. Dev)	(0.71)	(0.85)	(0.86)	(0.80)	(0.87)	**(0.18)**
Ecological	Mean	2.62	3.05	2.84	2.91	2.86	**2.86**
	(St. Dev)	(0.87)	(1.05)	(1.06)	(0.96)	(0.94)	**(0.15)**
Grand	**Mean**	**2.84**	**3.00**	**2.78**	**2.76**	**2.83**	**2.84**
	(St. Dev)	**(0.17)**	**(0.16)**	**(0.30)**	**(0.18)**	**(0.10)**	**(0.09)**

Appendix K. Cluster Analysis Results Used to Determine Optimum Number of Clusters

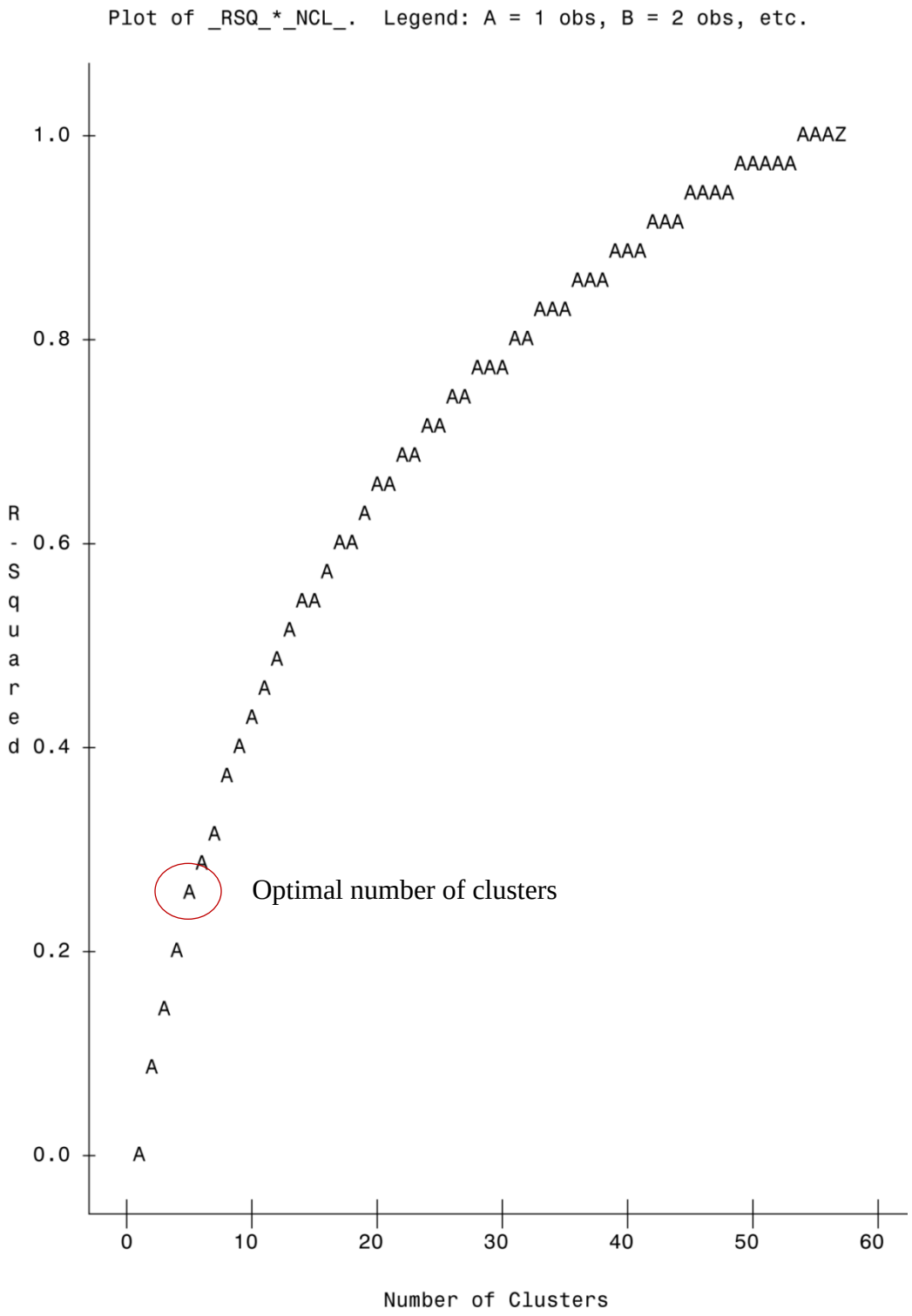
Between-Cluster Sum of Squares Graph (Calculated using SAS Statistical Software)



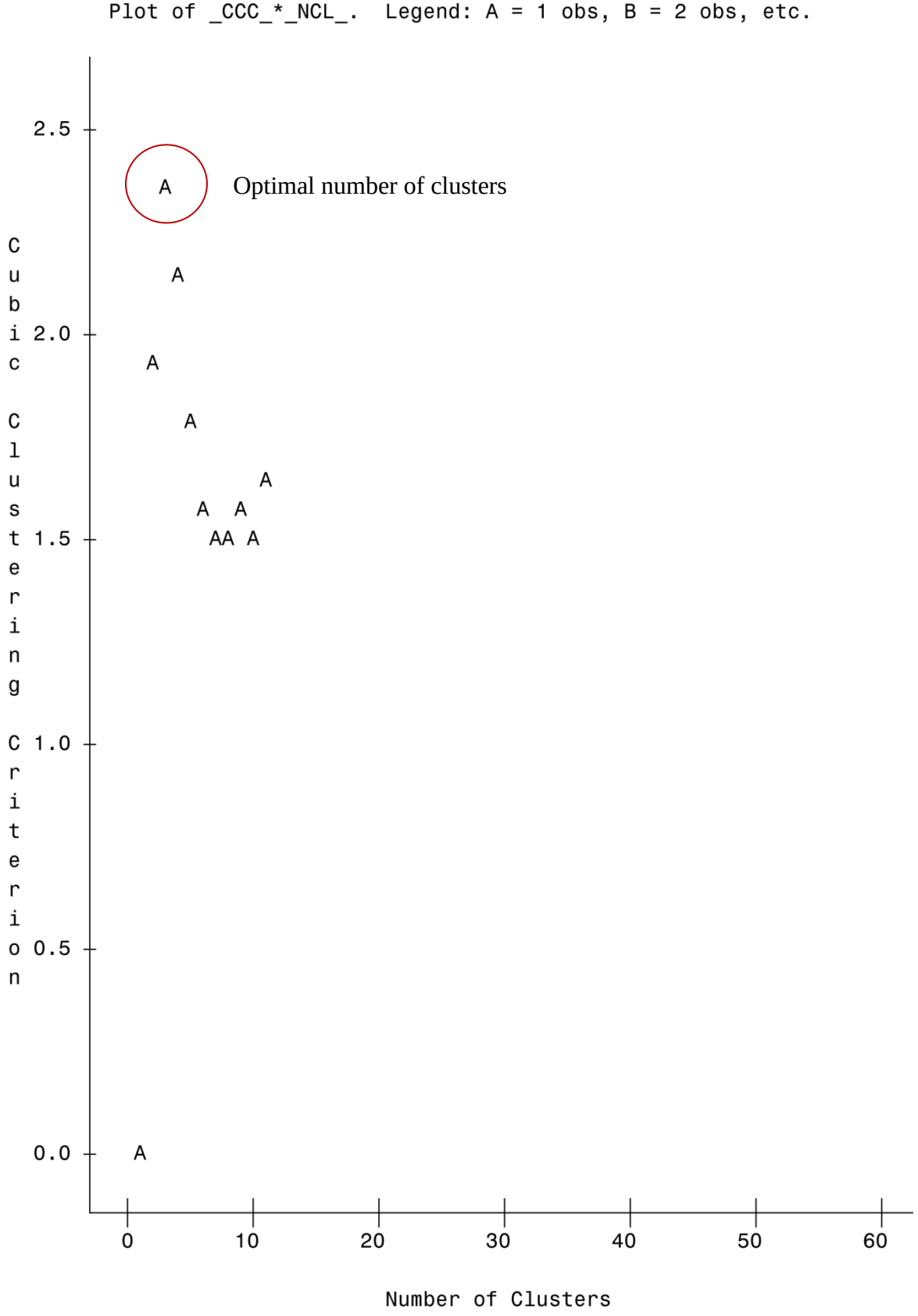
Semi-partial R-squared Graph (Calculated using SAS Statistical Software)



R-squared Graph (Calculated using SAS Statistical Software)

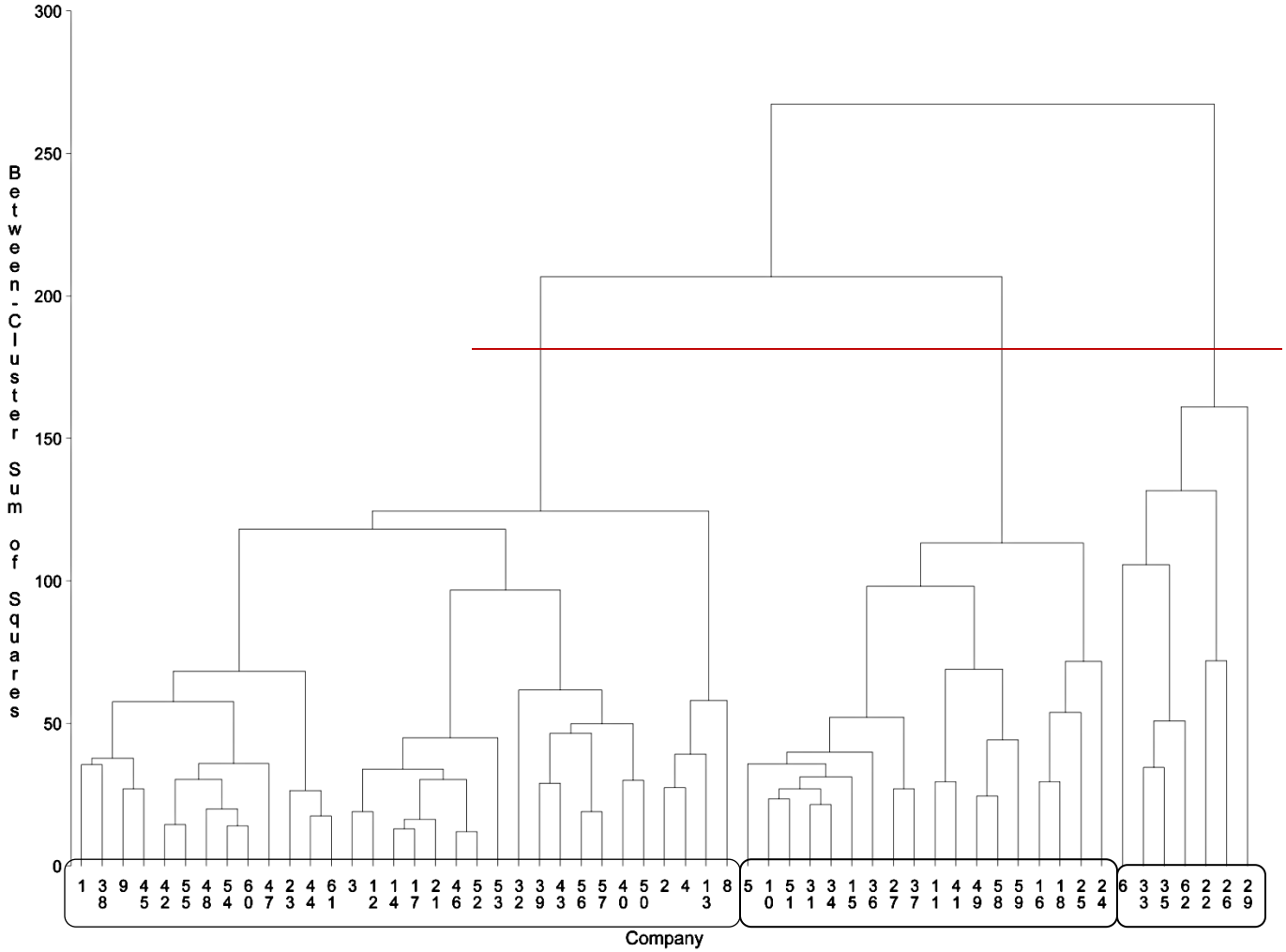


Cubic Clustering Criterion Graph (Calculated using SAS Statistical Software)

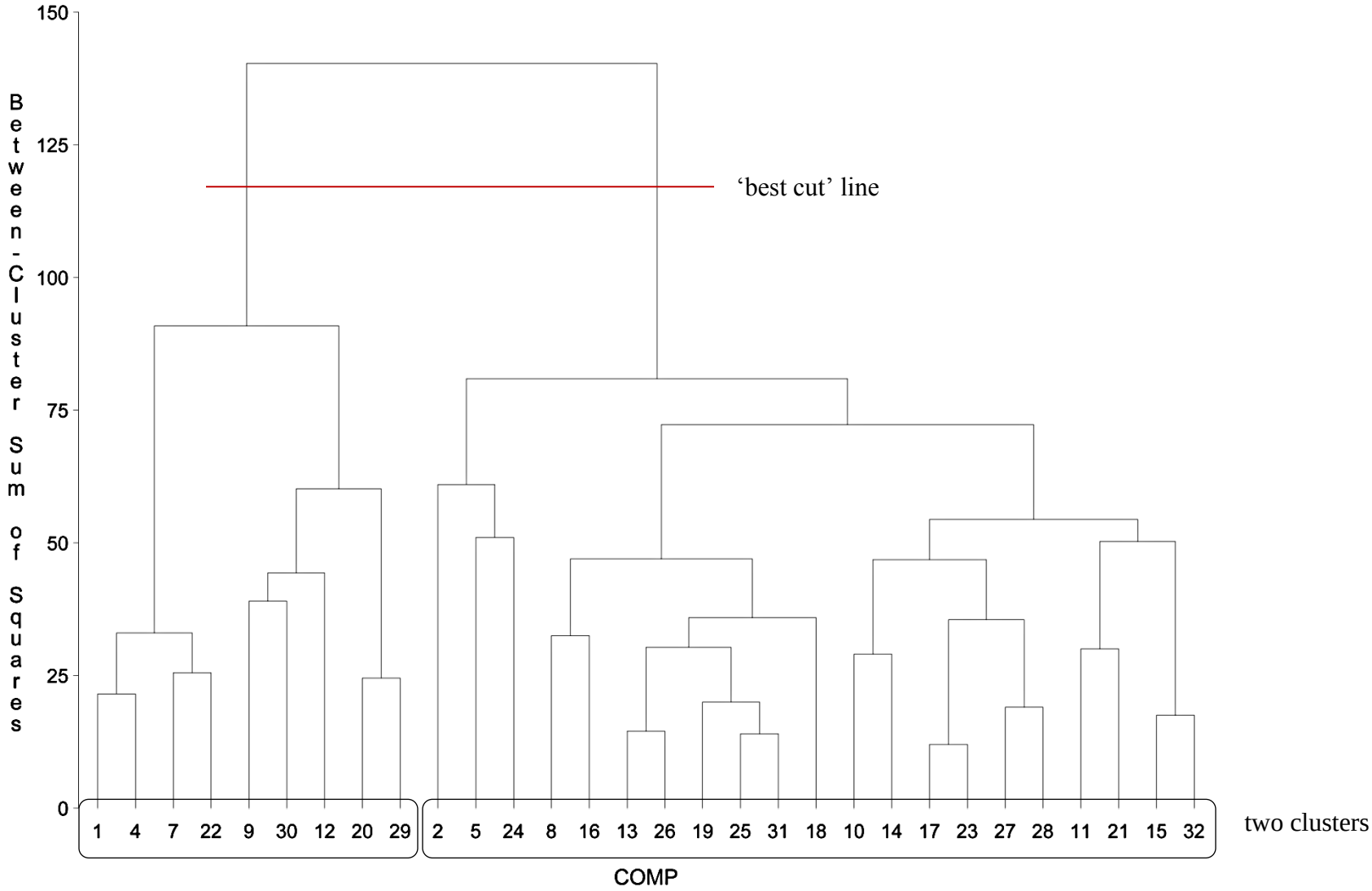


Appendix L. Dendrograms Indicating 'Best Cut' Lines for Cluster Partitions

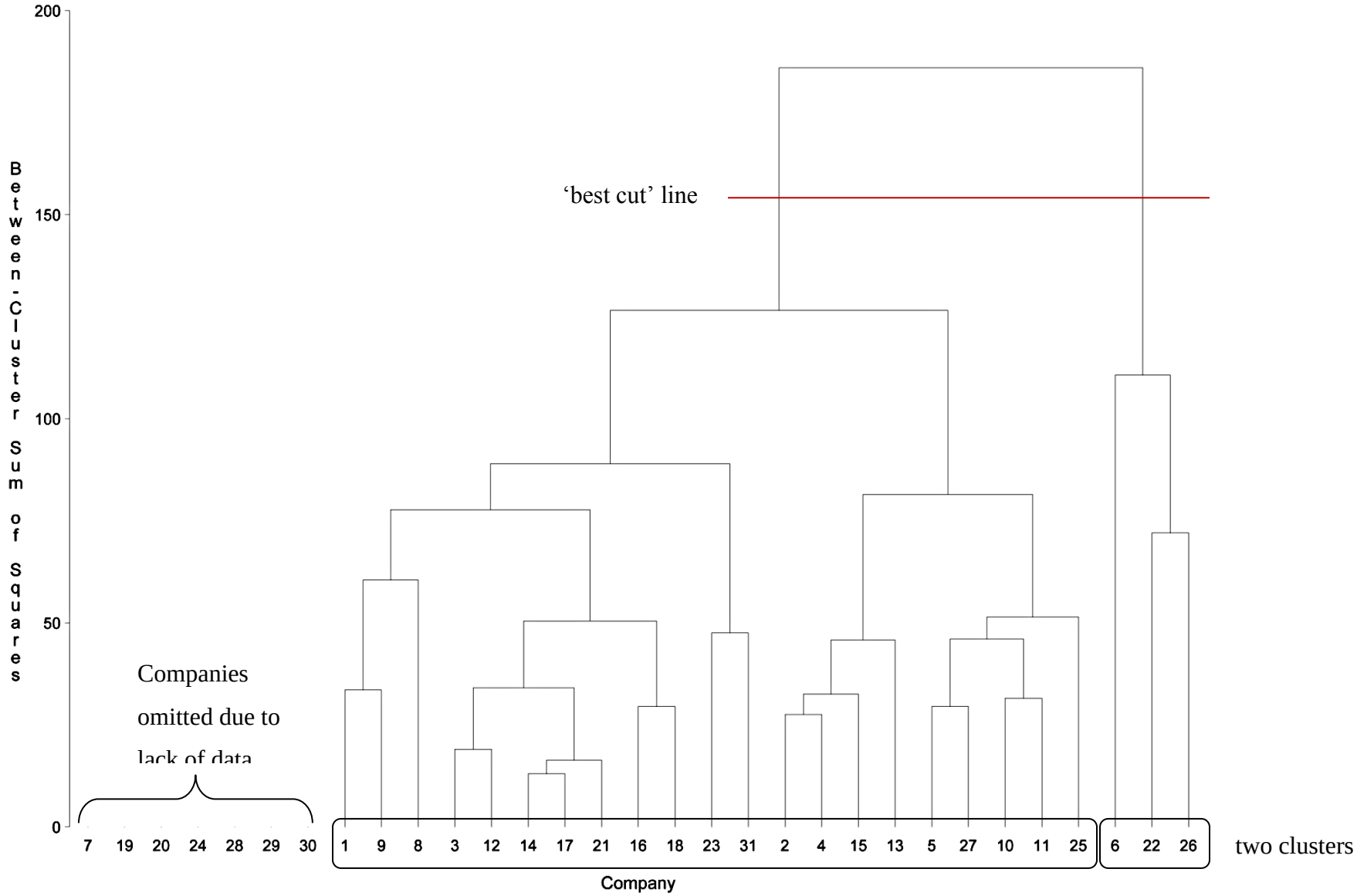
Dendrogram including all Survey Respondents (Calculated using SAS Statistical Software)



Dendrogram including only US Companies (Calculated using SAS Statistical Software)



Dendrogram including only Austrian and German Companies (Calculated using SAS Statistical Software)



Appendix M. Comparison of Means of Individual Survey Items Used to Create Impacts Identified to be Significantly Different Between Clusters

Comparison Between Cluster 1 and Cluster 2

Survey Items	Means		W-statistic	t-approx.
	C1	C2		
SS*TECH				
a) Advances in supply chain technology have improved my firm's ability to identify and track new sources of supply	2.67	2.62	141.0	0.9621
b) Advances in veneer slicing technology have increased the range of log qualities my firm can purchase and produce	3.00	2.67	153.0	0.5302
SS*POL				
a) Export trade policies have aided domestic sourcing of raw materials	2.44	2.24	150.5	0.6178
b) The Lacey Act has not created a trade barrier for my firm	3.56	3.19	166.5	0.2026
PM*ECON				
a) Lack of availability of capital has positively impacted my firm's ability to improve its production methods	3.56	3.15	154.5	0.3561
b) Collaborations with educational institutions have improved my firm's production methods	2.89	2.76	147.5	0.7067
MA*SOC				
a) Regional consumer product preferences allow my firm to enter new markets	3.67	2.90	181.5	0.0276
b) Cultural differences are a facilitator for my firm's identification of or entrance into new markets	3.67	3.14	165.5	0.2359
MA*TECH				
a) Supply chain technology has helped my firm identify or enter new markets	3.33	3.29	141.0	0.9616
b) Technological advances outside the veneer industry have improved my firm's ability to find or enter new markets	3.11	2.67	171.0	0.1177
MA*ECOL				
a) The location of my firm's facilities provides a competitive advantage for finding or entering new markets	3.78	3.33	165.5	0.2232
b) The small size of the US veneer industry improves my firm's ability to find or enter new markets	3.11	3.10	137.0	0.9403

Survey Items	Means		W-statistic	t-approx.
	C1	C2		
PS*TECH				
a) New technologies have improved my firm's capability to develop and offer new products or services	3.78	2.86	200.5	0.0068
b) Advancements to supply chain technology have aided my firm's efforts to develop and offer new products or services	3.00	2.75	133.5	0.3278
BM*POL				
a) Legal restrictions on lending have allowed my firm to reorganize in a way that creates value	3.67	2.95	178.5	0.0761
b) Current regulations improve my firm's ability to create a competitive advantage in the global marketplace	2.78	2.38	162.0	0.2887

Comparison Between Cluster 1 and Cluster 3

Survey Items	Means		W-statistic	t-approx.
	C1	C3		
PM*SOC				
a) The need for a safer working environment has caused my firm to improve its methods of production	2.89	3.11	155.5	0.6772
b) Demographic changes in the workforce have improved my firm’s production methods	3.22	3.15	176.5	0.7093
MA*ECOL				
a) The location of my firm’s facilities provides a competitive advantage for finding or entering new markets	3.78	2.88	226.5	0.0157
b) The small size of the US veneer industry improves my firms’ ability to find or enter new markets	3.11	2.92	171.0	0.5978
MA*POL				
a) International marketing efforts of trade associations have aided new market development for my firm	3.22	2.36	212.0	0.0281
b) Current government policies aid my firm’s efforts in finding or entering new markets	3.00	2.27	218.5	0.0300
PS*TECH				
a) New technologies have improved my firm’s capability to develop and offer new products or services	3.78	2.96	238.0	0.0184
b) Advancements to supply chain technology aid my firm’s efforts to develop and offer new products or services	3.00	2.77	155.0	0.5110

Survey Items	Means		W-statistic	t-approx.
	C1	C3		
BM*SOC				
a) Ensuring worker safety enhances my firm's ability to generate value	3.22	2.88	191.5	0.2312
b) Adaptations to changes in consumer demand creates opportunities for value-generating firm reorganizations	3.56	2.88	211.0	0.0610

Comparison Between Cluster 2 and Cluster 3

Survey Items	Means		W-statistic	t-approx.
	C2	C3		
SS*TECH				
a) Advances in supply chain technology have improved my firm's ability to identify and track new sources of supply	2.62	2.96	457.5	0.2904
b) Advances in veneer slicing technology have increased the range of log qualities my firm can purchase and produce	2.67	2.86	493.0	0.3892
SS*ECON				
a) Exchange rate changes do not force my firm to alter where raw materials are sourced	3.15	3.39	456.6	0.4764
b) Domestic raw material supplies are affordable for my firm	2.33	3.32	372.0	0.0021
SS*POL				
a) Export trade policies have aided domestic sourcing of raw materials	2.24	2.93	405.0	0.0155
b) The Lacey Act has not created a trade barrier for my firm	3.19	3.37	485.5	0.5144
PM*ECON				
a) Lack of availability of capital has positively impacted my firm's ability to improve its production methods	3.15	3.44	451.5	0.5310
b) Collaborations with educational institutions have improved my firm's production methods	2.76	2.73	509.5	0.9080
BM*SOC				
a) Ensuring worker safety enhances my firm's ability to generate value	3.24	2.88	581.5	0.0635
b) Adaptation to changes in consumer demand has created an opportunity for my firm to reorganize in a way that creates value	3.29	2.88	572.0	0.1309