Understanding external firm factors impacting innovation in the hardwood veneer industry

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Table of Contents

I. Executive Summary

Innovation research in the wood products industry has historically focused on factors that the firm can influence or control (i.e. climate for innovation, organizational culture, job satisfaction, etc.) (Hovgaard and Hansen, 2004), as opposed to factors external to the firm that it may not be able to directly influence or control (political, economical, social, technological, or ecological) (Andrews, 1999). The purpose of this paper is to understand how the external factors of the firm impact innovation in the wood products industry, specifically, the hardwood decorative veneer producing firms. This work uses Schumpeter's five-factor model of innovation to investigate strategies hardwood veneer firms use to innovate. Additionally, external firm factors are evaluated from a qualitative perspective based on their impacts to each of Schumpeter's five areas of innovation.

II. Introduction

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 the firms of the hardwood veneer industry to the point of plant closures and drastic cutbacks in terms of human resources and productivity. 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, which are typically 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 done due to the more numerous 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 in the veneer industry has been a factor for some 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 by this theory 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 of veneer industry firms by giving insight into how the environmental factors will impact innovation within this 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.

III. Objectives and Potential Outcomes of the Research

The primary aim of this research is improve the understanding of the impacts environmental factors have on hardwood veneer industry firm strategies and to provide the industry with actionable recommendations to improve their innovativeness. A secondary objective of this research is to disseminate the findings to the industry through benchmarking reports to industry firms participating in the research as well as through publication of the research findings. Specific objectives of this research are:

1. To investigate strategies that hardwood veneer industry firms use to innovate.

2. To describe how environmental factors impact hardwood veneer firms' innovation strategies.

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

Two main outcomes of this research are strived for: 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 storytelling 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.

IV. Literature Review and Theoretical Background

A. The Hardwood Veneer Industry

The hardwood industry can be segmented into primary or secondary wood products manufacturers. Primary wood products manufacturers are those producing goods directly from logs or roundwood, whereas secondary wood products manufacturers utilize products from the primary producers to produce goods to be sold to the end consumer. The hardwood veneer industry is a primary producer of forest products, purchasing their raw materials as either logs or standing timber. An industry is defined as a group of firms whose products are close substitutes for one another (Porter, 1998).

Veneer is defined as a "thin slice of wood; its thickness is determined by the end use" (Lincoln, 1984). Veneer can be produced via horizontal or vertical slicing, rotary peeling, or sawing logs or lumber into thicknesses from 0.1 mm to 7 mm (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, while decorative veneer is used for its "surface aesthetic appeal" (Lincoln, 1984). Applications of decorative veneer include 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 selling 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 2007, production of veneer sheets (construction and decorative grades, excluding veneer used in plywood) in Austria was 23,000 m^3, in the US was 400,000 m^3, and in China was an estimated 3,154,000 m^3 (FAOSTAT, 2009a). Other developed and developing markets for veneer production can be found in Southeast Asia (1,252,400 m^3), South America (1,233,000 m^3), India (270,500 m^3), Eastern Europe (501,741 m^3) and Africa (987,900 m^3) (FAOSTAT, 2010). Globally, production of veneer sheets in 2007 was 11.8 million m^3 (FAOSTAT, 2010). However, the hardwood veneer industry firms of Austria 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). There were 9 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 wood products sector is also one of the largest employing sectors in the United States. 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 by 2009 (HPVA, 2009).

The hardwood veneer industry is important not only to the wood products sectors of both Austria 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, 2009b). 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). In 2008, Austria exported 28,300 m^3 of veneer sheets (construction and decorative grades) valuing more than $85 million and imported 49,600 m^3 of veneer sheets valuing more than $120 million

(FAOSTAT, 2009a). In 2008, the production quantity of non-coniferous sawlogs and veneer logs in Austria was 418,575 m^3 (FAOSTAT, 2010).

Similarly, the forest acreage in the US accounts for 33% of the country's total land area (FAOSTAT, 2009b) 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). In 2008, the US exported 279,911,000 m^3 of veneer sheets valuing $414 million and imported 261,998 m^3 of veneer sheets valuing $377 million (FAOSTAT, 2009a). In 2008, the production quantity of non-coniferous sawlogs and veneer logs in the US was 51,730,000 m^3 (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 are 17 industries that supply the hardwood veneer and plywood industries, while 69 industries consume resultant products (researchandmarkets.com, 2009).

The hardwood veneer industries of Austria 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, 2000/02). 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.

In contrast, the United States has had to adapt to resource 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 2. The US consists of 33% forested area (FAOSTAT, 2009b), with the eastern United States boasting the only domestic source where all the major broadleaved

Table 1. 2007 Austrian import and export partners of veneer sheets in terms of quantity and value

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, 2009a)

Table 2. 2007 US import and export partners of veneer sheets in terms of quantity and value

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, 2009a)

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 $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.

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.

The subsequent steps involved in manufacturing hardwood veneer are summarized from Furnierwerk Fritz Kohl GmbH & Co. KG (2006), as follows:

Preparation for cooking

The bark of the log is removed, the log is sent through a metal detector, and the log is sawn in halves or quarters (called flitches, depending on the size of the log and desired look of the veneer. The flitches are typically banded together in some fashion to keep all parts of the log together.

Cooking or steaming

The logs are loaded into large vats and most often cooked under pressure at high temperatures for lengths of time that vary by species. Some species are steamed instead of cooked.

Planing

The outer layer of sapwood discolors during cooking and is most often discarded as waste material, so this layer is planed off before slicing.

Slicing

Veneer can be sliced with vertical or staylog slicers for most species. Rotary lathes are used to slice burls and some exotic species. Horizontal slicers are the least common type but are sometimes used for lumber slicing or to slice very thin veneer.

Drying

Some veneer can be dried directly after slicing, while other species need to be wet for a certain period of time in order for color changes to occur. As the veneer is dried, it is stacked into bundles varying in the number of sheets from 16 to 30, depending on species and cut of veneer.

Clipping

Sapwood and other natural characteristics of wood are clipped out to provide a greater value to the consumer. Historically, clipped veneer was exported from the United States to European markets, and unclipped veneer, or flitch stock, was used domestically within the United States. However, the trade off of purchasing waste material for the ability to make clipping decisions is becoming more undesirable.

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 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* 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).

*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.

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:

> 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 innovates 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, or 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, or 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 sales only/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 sales only operations or other veneer traders. 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 sales only, or 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 sales only firms or production firms. The sales only firm structure does not include the sales outlets of 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 spliced face manufacturing for 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.

B. 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).

In terms of innovation management, innovation can be:

> the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order (Van de Ven, 1986).

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).

Further emphasis of the innovation process within organizations results in the definition of an innovation as:

> the adoption of an internally generated or purchased device, system, policy, program, process, product or service that is new to the adopting organization (Damanpour, 1991).

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 business models, and sources of supply are procurement sources. In this work, Schumpeter's terms are often used interchangeably with the terms of other theorists, yet the meaning remains Schumpeter defined.

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, market 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) conducted research most specific to identification of the dimensions of innovativeness, and determined that three dimensions can be used to describe the wood products industry: product, process and a catch-all dimension called 'business systems'. A study on impacts to innovation strategies in the hardwood veneer industry would be a valuable contribution to current wood products industry knowledge.

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.

C. 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. 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 are further described as follows:

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) also stressed the importance of following changes in demographics 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). 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).

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 suffice 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) 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.

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).

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 realized 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.

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 has 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). New ways of distributing these goods to customers need to be routed to not only accommodate a change in trade flows from domestic to export, but to alleviate the problems in shipping. 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). New relationships may incite new ideas for products or services, which may cause a need for new sources of supply to accommodate new product needs, such that innovative supply chain arrangements or even new business models result.

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).

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.

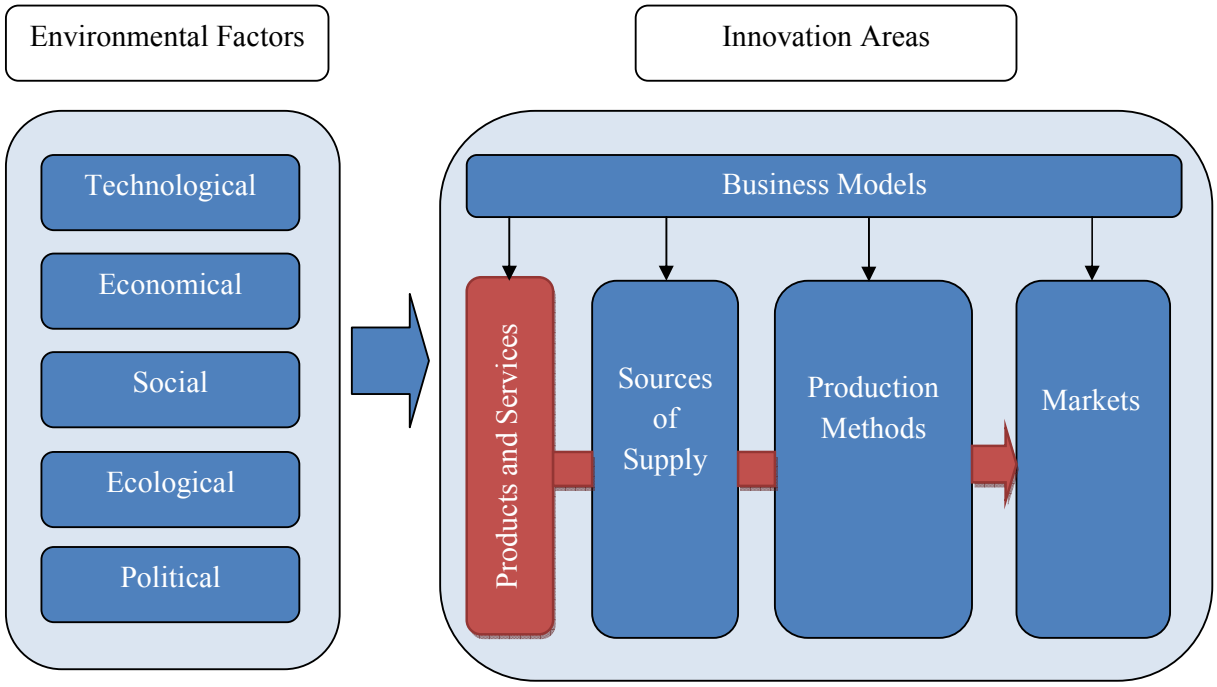

Figure 1: Hypothetical Model of Environmental Impacts to Innovation

A hypothetical model of the environmental impacts to innovation strategies is shown in Figure 1. 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.

D. Research methodology

In order to explain the impacts the aforementioned 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 a whole industry 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 structures, a multiple case study approach that allows theoretical sampling from each of the structure groups is preferred. Eisenhardt (1989) suggests and Harrigan (1983) an approach to building theories from case studies, which allows theoretical sampling of case studies for analysis. 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 simultaneous data collection with data analysis along with the iterative nature of case study research allows these hypotheses to be created at an appropriate time during the study and then tested (which will be described later in this section).

Eisenhardt (1989) created the following stepwise process of building theory from case study research, including activities and reasons for performing those activities:

Getting Started

The first thing to do is define the research question in order to focus the efforts of the study. Some a priori constructs may be defined in order to provide better grounding of the construct measures. However, the beginning stages should not include development of theory nor hypothesis to retain theoretical flexibility.

Selecting Cases

This step of the process involves specifying a population that will constrain extraneous variation and also to sharpen external validity. Theoretical sampling should be undertaken as opposed to random sampling in order to focus efforts on theoretically useful cases, or those cases that replicate or extend theory by filling conceptual categories.

Crafting Instruments and Protocols

As with most case studies, multiple data collection methods are 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.

Eisenhardt (1989) also recommends the use of multiple investigators to foster divergent perspectives and strengthen grounding of theory.

Entering the Field

Overlapping data collection with data analysis speeds analyses and reveals helpful adjustments to data collection. The use of 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

In order to shape the hypotheses, iterative tabulation of evidence for each construct should be performed. This will 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 during this step in order to make a comparison with conflicting literature that will build internal validity, raise the theoretical level, and sharpen the construct definitions. Comparisons should also be made with similar literature in order to sharpen generalizability, improve construct definition, and further raise the theoretical level.

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 is not applicable to 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.

White (1973) identified four types of emplotment within the method of storytelling. White (1973) created the term 'emplotment' and defined it as the assembly of events into a narrative with a plot, much like the work of historiography research. The four types of emplotment are: romance, comedy, tragedy, and satire. A romantic story is one that describes a celebration of achievement after many failed attempts. Romantic stories have a purposive nature that dramatizes the triumph of good over evil and victory over experiences. A satire is the exact opposite of a romantic story, or essentially an ambivalent recreation of a romantic story dramatizing the captive nature of human experience. Satirical stories portray humans as completely vulnerable to the forces of nature. Comedies and tragedies lie somewhere in the middle. Comedies relay a hopeful message that at least humans have some control over their environment indicated by a celebration of achievement after lack of a transparent progression

toward the goal. Tragedies, on the other hand, tend toward a more negative perspective of the human experience of impending progress, failed. However, the tragedy, in essence, does depict a less threatening aura for the survivors of human experiences.

One could argue that romantic stories are synonymous with deliberate strategies, while their counterpart, satirical stories, are synonymous with emergent strategies. Comedies would lie on the more deliberate than emergent end of the spectrum, and tragedies would like on the more emergent than deliberate end of the spectrum. Viewing narrative interviewing in this way can be very helpful in both determining the innovation strategies of the firm and understanding the perceived interaction of those strategies with each of the environmental factors.

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 firms in the US and Austria, a census is a method that will be used in this research. In addition, due to the geographic limitations of working with firms on two continents, an online survey will be 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. 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 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 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.

V. Methods

A. Innovation strategy identification

In this research project, 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. Firms from each of seven categories of veneer firm structure were

selected in both Austria and the US via stratified, theoretical sampling for individual case study analysis. In addition, due to their extensive knowledge of impacts to veneer industry firms, industry associations in both Austria and the United States were included in this sampling.

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. Evaluation of strategies can be conflict inducing, due to concerns over who is qualified to give an objective evaluation (Rumelt, 1987). Due to the necessary insight required to thoroughly understand the innovation strategies of the firm in order to give an objective, accurate evaluation; the innovation strategies of firms were identified but not evaluated. 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), while qualifications of the interviewer can be found in Appendix F. 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 deliberate choice? 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. These stories serve as the beginning of innovation strategy identification. Interviews were transcribed and analysis of interview transcripts was aided by use of a computer program for qualitative data analysis (i.e. NVivo 8). Narrative interviews were first analyzed by identifying the type of emplotment of each story. The emplotment of each story helped to generate initial hypotheses that can be tested by survey research and cross-firm or cross-country analysis. For example, initial interviews indicated that certain firms interviewed in Austria told their innovation stories using romantic emplotment, while the innovation stories of other firms were primarily told using comedy emplotment. One hypothesis could be that certain types of firms, with similar scale and scope, have the intention to innovate (i.e. have

deliberate strategies and/or tell their stories using romantic emplotment) while other types of firms have emergent strategies. This hypothesis can be further supported via document analysis of brochures supplied by the firm or a copy of the firm's mission statement, and tested across veneer industry firms in the US and Austria via survey research. Identification of the emplotment is important because some firms may not distinguish an innovation strategy from their overall firm strategy, and emplotment will help glean this information from each narrative interview. In addition, using emplotment to identify emergent from deliberate strategies is a more thorough way of identifying causal factors of the environment that impact innovation strategies.

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 (see Approach 2 in Appendix E). Qualitative data was analyzed first 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 of innovation in a particular area. Multiple accounts can build support for a specific type of innovation strategy of the firm (i.e. strong product innovator).

Secondly, qualitative data was analyzed to 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 hypotheses. For example, data analysis showed that two certain types of Austrian veneer firm had strong innovation tendencies, and it is hypothesized that these same types of American veneer firms will 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 have been generated during this step include between country differences in innovation type prevalence and between firm structure differences in innovation type prevalence. The hypotheses that have been generated during this step will be given in the conclusions section of this work. In a future part of this study, these hypotheses will be tested via census survey to Austrian 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 what this work will entail.

Following this initial data analysis and hypotheses creation, the internet census survey of American and Austrian hardwood veneer industry firms will be conducted following the tailored design method (Dillman et al., 2009). This survey will include qualitative and quantitative elements in order to more fully analyze the industry as a whole. For example, the online survey questionnaire will include questions that identify the type of firm business model in use, questions that quantify the number and types of innovations the firm has began or introduced, and questions that provide an indication of how successful the firm is compared to other firms in the veneer industry. This type information will greatly help to develop recommendations to aid firms in being more innovative.

Each survey question will relate to a hypotheses and many of the questions will be 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) can be asked. The binary responses can be used to determine whether or not that type of innovation should be included in the model. The nominal responses can provide data to analyze using cluster analysis. This type of analysis will provide groups of firms that represent similar innovation strategy types. Each firm can be considered an object n and the five types of innovation can be a variable p that can be used to create an n x p matrix. An algorithm can be used to partition the data into groups naturally represented by the data. Once these groups are formed, a discriminant analysis should be conducted on the

data to determine if these groupings are valid, to give the groups discriminant functions, and to create scatter plots of all firms. These types of data analysis can provide support for or against the hypotheses and insight into the innovation strategies in use in the veneer industry.

Survey results will be used to substantiate information found during narrative interviews. Models developed to describe firms innovation strategies will be compared and contrasted for US and Austrian firms. Innovation strategies will also be compared across the four types of firms in an attempt to find patterns in the data that can more clearly explain the phenomena.

B. Environmental Analysis

The identification of environmental factors within each of the five categories (STEEP) 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 D (in English) and Appendix E (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 are 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 help 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 expect 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 technology for slicing veneer has impacted their innovation in methods of production. One hypothesis is that veneer firms in the United States are experiencing the same situation that has encouraged them to innovate their production themselves. Further interviews of veneer industry firms in the United States may indicate that other technologies, like supply chain or photographic technologies are impacting their innovation strategies as well. Survey questions will be created for the veneer industry firm census survey that will test which technologies are having more of an impact in Austria and which are having more of an impact in the United States. Each of the technologies will be rated for the level of impact they are having on production method innovation. This information can be used to test the hypothesis and substantiate information gathered from narrative interviews. The remainder of this section describes the data analysis that will be completed on the survey results.

The survey data for STEEP factors can be analyzed using contingency table analysis. Using the previous example of different technologies impacting production method innovations, a survey to veneer industry firms could list the technologies identified during narrative interviews as impacting innovation strategies. The respondents could be asked to check 'yes' (=1) or 'no' (=0) that they believe each technology on the list impacts their production method innovation strategy. Subsequent questions on the survey could ask respondents to rate each technology on a Likert scale (i.e. 'strongly disagree'=1, 'disagree'=2, 'neither'=3, 'agree'=4, or 'strongly agree'=5) as to how much each technology impacts their production method innovation strategies. The scores from Likert scale responses on technological impacts to production method innovation can be added together to create a technology score. This score can be added to a 5 x 5 table that looks similar to Table 3. The nominal dimension of innovation areas could be listed as columns and the nominal STEEP factors could be rows, while the cells could be occupied by Poisson count data. The contingency tables for each firm can be grouped by their innovation strategy, and then compared with other firms having the same innovation strategy to see if they are responding in the same way to the

environment. These tables can also be compared across innovation strategies to get a better understanding of how the STEEP factors impact innovation (i.e. whether firms across all strategies are responding in a similar fashion or if they respond in different ways).

Table 3. Hypothetical Contingency Table for a Respondent Firm

	Sources of Supply	Methods of Production	Markets	Products or Services	Business Models
Social	4	6	5	7	5
Technological	3	12	9	9	5
Economic	8	9	10	6	8
Ecological	8	7	7	9	6
Political	9	3	6	6	6

In a contingency table analysis it is possible to test the hypothesis that there is no association between the nominal innovation areas and the nominal STEEP factors. Failure of this test indicates that some kind of association exists. Goodman's full-rank interaction analysis may be used to determine the interaction effects among column and row variables. Patterns among firms may be determined to help understand which STEEP factors seem to be interacting with the innovation factors. Further analysis of the qualitative data may indicate reasons for these interactions. The results would be a model of the relationships the STEEP factors have with the different types of innovation. One model that depicts the results of data analysis for both innovation strategy classification and initial analysis of STEEP factor data from all Austrian survey results is shown in Figure 2. This model does not depict the potential interactions of STEEP factors with the innovation strategies.

The analysis of survey data and narrative interviews may incite more questions about the cause of, for example, technological impacts on production method innovation. It may be necessary to conduct interviews of specific supply chain technology firms to gather more information. The survey of veneer industry firms could identify some potential impacts of the supply chain technology to production method innovations, and the environmental expert interviews could identify intricacies of the technology that may produce this impact.

This iterative approach to the methods of data collection will be used to determine the causes of environmental impacts to innovation. Simultaneous data collection and data analysis are imperative to establishing the causal relationships and identifying recommendations that the

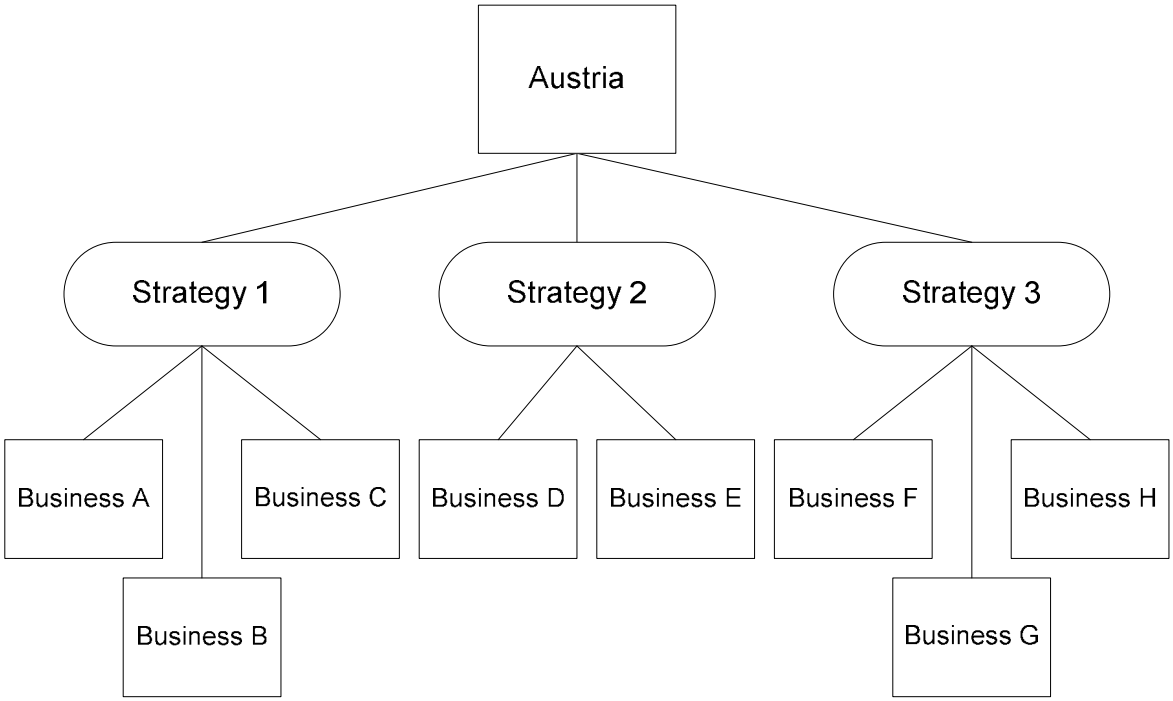

Figure 2. Hypothetical Model of Research Outcome

veneer industry firms or environmental experts may use to remove roadblocks to innovation. After surveys have been collected and analyzed, returning to the literature to search for opposing viewpoints would also be a good way to help strengthen and explain the empirical findings.

C. 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. In the future of this study, census survey results will be analyzed for quantitative support of the hypothesis testing. One method used for qualitative data analysis was a SWOT analysis. For instance, the technological impacts to production method innovation were explored for opportunities to innovate and threats to innovation. 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. The results of this preliminary study were used to create initial recommendations for the veneer industry of what steps can be taken to help them develop technological innovations in industry firms production processes.

Some strengths and weaknesses will be presented from an industry-wide perspective. Not all firms in the population will 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 the SWOT analysis, Step 3 of Aeberhard's method of global environmental analysis involves developing a prognosis for the future of each element. The responses from the environmental expert narrative interviews can help with this step. Some experts did not give information regarding their future prognoses in their area of expertise. In this case, a best guess was described given the information provided.

Using the future state prognoses identified through narrative interviews and the model developed of the environment veneer industry firms currently experience, Step 4 of the Aeberhard method will be completed. If data are sufficient, changes will be transposed onto the current model and a future state model will be created.

VI. Results

The data collection for this research is being conducted in two parts. The first part was conducted in Austria under the auspices of the Austrian Marshall Plan Foundation in Vienna, Austria, and the Department of Wood and Biogene Technologies at the Salzburg University of Applied Sciences in Kuchl, Austria. The second part is being conducted in the United States under the auspices of the Department of Wood Science and Forest Products at Virginia Polytechnic Institute and State University in Blacksburg, Virginia. Provided the structure of the Marshall Plan Scholarship, the data analysis and results in this work are the product of the first part of the data collection. The second part of the work will provide more comprehensive results and analysis by including both Austrian and the United States data collections. The remainder of this paper contains results of only narrative interviews of Austrian hardwood veneer firms and environmental experts.

Due to the small size of the hardwood veneer industry in Austria, and in order to protect the identities of firms, the firm structures used in the theoretical sampling will not be disclosed. Identification of the firms will be by a letter only. Upon completion of the entire study, Austrian and American firms that participated in interviews and surveys will receive a copy of the results with only the letter of their firm disclosed. Firms will be able to compare their results against similar firms in the other country, as well as against other firms in their own country. A table indicating the date of each company interview can be seen in Table 4.

Date	**Interviewee**
July 15, 2009	Economic Expert
July 20, 2009	Company D
July 20, 2009	Technology Expert
July 28, 2009	Political Expert
July 29, 2009	Ecological Expert
July 30, 2009	Company C
August 4, 2009	Company B
August 14, 2009	Company A
September 8, 2009	Social Expert

Table 4. Austrian Interview Schedule for Summer 2009

Innovation strategy identification

Top management from four Austrian firms were interviewed in the summer of 2009 and asked to tell a story about a time when their firm had innovated in each of Schumpeter's five areas of innovation. A preliminary analysis of the data suggests that production method innovation was the most prominent area of innovation in the hardwood veneer industry, followed by a tie between products/services, and business models. Rounding out this list was a tie between sources of supply and market innovations. Some of the insights from the companies regarding each innovation type are listed below.

Production method innovation was the most prominent type, with all four companies responding in some way that they have innovated in this area. Some firms that purchase existing machinery make small improvements to the machines in order to optimize their production, while other veneer companies produce new machinery of their own. Innovation in this area extends on the range from incremental steps, to radical new machines that increase the efficiency of production through faster output and replacement of workers for

machines. Some production methods have been innovated in order to produce new products that are a creation of the firms ideas, while other production methods have been created to optimize customer satisfaction of the products.

Product or service innovations were cited by three of the four companies as areas of innovation in their firms. These new products and services were often the result of another area of innovation. 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. Vertical integration and virtual integration were both additional means of creating new products and services for veneer firms interviewed for this study.

New business models were formed by three of the four Austrian companies interviewed. These business models were often developed for the firms to focus on core competencies, create synergies among different business units, or to offer new products or services. The decisions were also often scope or scale related decisions. Companies that innovated in this area had typically described this innovation as occurring early on in the life of their company or even shortly after founding the firm, many citing market demands placed on their firms as a reason for the innovation.

Two of the four companies identified source of supply innovations of their firms. 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 the scale and scope of the firm. Firms that innovated in this area tended to cite new species that differed from their current offerings to new suppliers from either different parts of the world or of new types as their primary mode of innovating in this area.

Finally, two of the four firms described their creation of a new market. One of the firms did so in combination with a business model innovation. Both markets existed before, but the use of veneer was new to the markets. The firms that did not innovate in this area discussed their difficulties of creating a new market for hardwood veneer. There are several existing outlets for veneer, typically described by firms as product type outlets or regional outlets. Some markets are expanding, most are contracting, and very few new ones are being created.

In terms of emplotment, a majority of the stories told by firm representatives were either romantic or satirical, with eight and seven stories respectively. Only three stories were more

deliberate than emergent, and one story was a tragedy. Each representative had a propensity to tell their stories in one form of emplotment. For example, two firms told four out of five stories in the romantic form, and the other two firms told three out of five stories in the satire form.

When asked whether or not it was a goal for the firm to innovate in each area of innovation, firm management was split almost in half. Eleven of twenty responses were 'yes' and the remaining nine were 'no'. Three out of four managers said it was a goal to innovate in both production method and product/service area innovation. Two out of four managers had goals to innovate their firm's sources of supply and markets, while only one firm indicated it was a goal to innovate their business model.

In order to analyze the data for innovation strategies of hardwood veneer industry firms, NVivo 8 software was used to develop associations among the innovation types present in the firms, as identified through narrative interviews of firm management. The innovation strategies were categorized into two different types: those strategy types the firms are pursuing, and those strategy types the firms have realized. The pursuit of an innovation strategy type was identified through the emplotment of each story told by firm management for each innovation type, as well as the data of whether or not each innovation type was a goal of the firm or not.

Of the Austrian hardwood veneer industry firms interviewed for this study, three of the firms are pursuing a revolutionary innovation strategy, and only one firm is pursuing a resource-building innovation strategy. In terms of the actual innovation strategies in use by those firms, three of the firms have a resource-building innovation strategy, and one firm has a regular innovation strategy.

Environmental factors

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. The results of those interviews are described below under headings of the five areas of innovation.

Sources of supply

As identified from interviews of top management, the environmental factors impacting a hardwood veneer industry firm's search for new sources of supply are ecological, political, economic and social in nature. The ecological factors impacting sources of supply deal primarily with forest certification and the importance of log procurement from legal, sustainable sources. Legal sourcing of timber is also a political issue, as there is legislation at the European Union level that is aimed to ensure the entry of only legal wood on the European wood markets. This issue is of paramount importance when searching for a supplier of a new species, perhaps of tropical origin. Forest certification is a means of aiding this effort by tracking wood through the supply chain back to the original source where it was harvested.

Firms tended also to cite the economic nature of log procurement as a factor impacting their procurement decisions. Finding legal sources of supply for species the firm wishes to offer having the quality desired and at the right price had an impact on the suppliers they purchased logs from. In addition, social factors indirectly impacted hardwood veneer industry firm's search for new sources of raw materials, as changing preferences of consumers in end-user markets has an impact on the availability of logs of certain species and qualities. Trends in consumer preferences in markets where consumers have the means to purchase veneered products impacts the quantity of high quality logs of certain species.

Methods of production

The environmental factors impacting a veneer firm's search for new methods of production are primarily technology related. The most often cited external firm factor related to innovation of production methods was the lack of technological advances to the current slicing equipment on the market. Hardwood veneer producers had a tendency to either make incremental improvements to the machinery on their own, work with external institutions (like universities) to make incremental or radical production method innovations, or make radical innovations to machinery solely in-house.

Markets

In terms of searching for new markets, the environmental factors of impact were economic in nature. The primary economic factor that firms cited was the current global economic crisis. Many firms previously had markets in the United States, but were forced to search for new

markets, both in terms of new applications for the use of veneer and in terms of regions that were not as impacted by the economic crisis (i.e. growing markets). More firms were seeking a focus in new regions as opposed to new applications for the product veneer.

Products and services

Hardwood veneer industry firms that innovated or were searching to innovate their products and services were impacted by environmental factors social, ecological and technological in nature. The primary social and ecological factors have to do once again with the trends in consumer preferences for species and qualities of veneer currently available on the market in relation to the regions where customers have the financial capacity to purchase veneered products. One firm stated the need for a flexible workforce in terms of their production to meet the changing needs of end consumers, which is once again social in nature. In terms of technology, one of the drivers of a firm's service innovation had to do with the availability of technology produced outside the veneer industry that had not been available and/or applied to the veneer industry before.

Business models

Lastly, in terms of business models of hardwood veneer industry firms, the environmental factor having the greatest impact was the current global economic crisis. Firms were having to reduce their workforces or close facilities in certain areas and change their focus to other areas in response to the changes in demand in the global wood products markets. One firm actually went out of business during the data collection of this project and was seeking the means to start up the business once again.

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. When we consider again the image of the 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. Though, it has not yet been determined from this work whether or not the respondents had looked beyond their industry competitive situation in the first level to the overall environmental situation, or

second level influences. This will be one of the hypotheses that can be tested via survey research, as well as explored in the hardwood veneer industry in the United States.

Environmental experts were subsequently interviewed to expand on the perceptions gained from interviews top management of Austrian hardwood veneer industry firms. Some of these environmental experts were able to speak specifically for the Austrian situation, but most were speaking on an international level, typically specific to the European situation. These environmental factors are described by type: social, technological, economic, ecological and political.

Social

The expert of social issues relating to the veneer industry in Austria was directly involved with an international trade union. As much as possible, information provided directly represents the situation in Austria.

In terms of sources of supply, there is an initiative in the European Union to not only ensure that the wood entering the European market is procured from sustainable, legal sources, but that the workers who harvest the logs receive fair wages for their work and are provided acceptable working conditions to work in. One of the ways this is done is through the forest certification process, which incorporated International Labor Organization (ILO) core standards in their principle certification standards. The implementation of these standards helps to ensure that a majority of wood products suppliers (and producers) adhere to the ILO conventions regarding freedom of workers to organize, freedom of bargaining, and the exclusion of forced labor and child labor. In other words, the social standards of the country or regional source of supply are upheld on a global level, not just for wood entering the European market.

Social factors impact methods of production by way of personnel that work in production. Innovations have a tendency to reduce the number of workers, but in many cases this is better for the workers because the machines do work that is often unsafe.

In terms of a veneer industry firm's search for new markets would be impacted by the regulations regarding worker safety and decent working conditions. If a veneer company wants to sell wood on the European market, it needs to ensure that these standards are upheld in its production.

Social factors typically have little impact on a veneer firm's search for new products. However, if the veneer firm wishes to incorporate a new service into its product offering, social factors play impact how the work will be done. For example, if a veneer firm offers differentiated products like panels in addition to veneer wants to incorporate finishing as a service to its customers, trade unions would be interested in how this service will impact the workers condition. The veneer firm would need to ensure that the service it provides is compliant with any regulations regarding the health and safety of workers.

In terms of business models, social factors may impact the combination of supply chain elements under the control of the hardwood veneer firm that could change the entire business model of the firm. For example, the ILO standards incorporated into forest certification principles and criteria have tried to expand the definition of what a worker is to include individuals working for contractors or subcontractors in the wood industry. This standard may influence the way a veneer firm procures tropical logs, it may influence the workers within its own production and it may influence the markets the firm sells to. The combination of these changes may cause the veneer firm to adapt its business model in order to be in compliance with the standards set for by the ILO.

In addition to impacting the five areas of innovation, social factors also impact and are impacted by other STEEP factors. For example, trade unions have a role in policy-making with regards to the health and safety of workers in the wood products industry. Social factors impact the technology that is used in a veneer production plant by ensuring that the technology in use has protections for workers safety, like guards and shields or dust collection systems. Social factors are also impacted by technology, when for example the technology is used to replace a worker that had been working in a dangerous environment.

Technological

The expert interview conducted for this interview was a representative from a supply chain technology company. It should be noted that contacts were made at two trade shows in Germany in 2009 (interzum in Cologne and Ligna in Hannover) with manufacturers of hardwood veneer slicing and drying equipment. Many of the manufacturers refused to be interviewed about their innovation, with one person even stating that they haven't made any recent innovations to their products. One machine manufacturer did make several attempts but could never be reached for an interview for this project.

In terms of searching for new sources of supply, this technology will not help the initial search to find a supplier or source of raw materials. But it can help in terms of tracking and making sure the material compliant with certain regulations (i.e. legal and/or certified timber) maintains its identity apart from other materials. This technology can also help distinguish the quality or other characteristics of supplies purchased from a supplier to ensure consistency and compliance with agreements. It can also help distinguish characteristics of supplies purchased from one supplier from of a different supplier. For example, quality of the material purchased from one supplier can be tracked and compared with the qualities obtained from other suppliers. Another example would be tracking the production efficiency of a new species or another material the firm has decided to offer to benchmark it against other species or other materials the firm produces to find out if offering this new species or material is worth it. The information obtained can be a source of information to the firm for decision-making about the sources of supply the firm has found.

The use of supply chain technology in the hardwood veneer industry has changed the way companies produce veneer. For example, if the company is producing veneer for the furniture industry, where color matching of veneer from different trees of the same species is very important, color measurement equipment has helped companies make these matches perhaps more consistently than and definitely with less strain to production workers. Another example would be changes the veneer manufacturer can make in terms of production efficiency through the use of supply chain technology. The machinery can track the time it takes to run a log or a batch through production. This can help the veneer producer optimize or make innovations to their equipment, like make adjustments to the speed of the slicers or dryers, that will make the production run more efficiently. This machinery has been an innovation as well as a source of innovation for the veneer industry.

Indirectly supply chain technology has aided the veneer industry's search for new markets. The veneer manufacturer can use data gathered by the supply chain technology to aid their decision-making about what markets to be in and which ones to get out of. Information regarding pricing from veneer sales to customers in the different regional markets, product type markets (i.e. door, panel, furniture, etc.) and even species markets can be tracked using this technology and then analyzed to make decisions.

In terms of products and services, supply chain technology can help with relationship management. Tracking the needs of the customers as well as the ability of the firm to meet

the customers' needs for species, quality, price and so on is a service that veneer manufacturers can provide by using this technology. In this way, supply chain technology can also be considered a service innovation. However, due to the fact that supply chain technology supports production, it only indirectly influences the types of products the veneer manufacturer produces by providing information about the supplies use to make the products, the production process, and the sale of the products.

Due to the fact that the technology provides information related to each area of the firm, from sources of supply, through the production process to sales, and even regarding the products and services the firm offers, supply chain technology can aid decision-making in terms of the business model the firm uses. Information regarding performance of each of the firm's business units can be used to change the overall business model of the firm. For example, if information supplied by the technology indicates that the firm has a core competency of supplying the right species in the right quantities and qualities to the panel industry and the firm knows more about this industry than the furniture or door industries, then it might be a logical choice to integrate into that industry. It might also be possible for smaller firms to use information about their business model gleaned from their use of supply chain technology to find a partner that will cooperate with them to leverage their core competency in some area, or even to purchase them and become the veneer department of a larger corporation that produces different types of products that use veneer.

It has been described that technology, supply chain technology in particular, has been an innovation in the veneer industry, but can also help the industry be innovative. Technology also has impacts with other environmental factors that impact firms in the hardwood veneer industry. For example, it has already been described that supply chain technology can help the firm with forest certification efforts by tracking logs purchased from certified sources through production to markets that demand such products. Usage of supply chain technology in the veneer industry has been impacted by the prevalence of forest certification efforts of firms, in that the makers of the technology had to adapt the technology to be compliant with the standards governing appropriate product tracking and labeling. Supply chain technology might also be used to comply with the new European Union regulation that aims to ensure all wood entering the European market is from legal sources by providing documentation and tracking of the product from the source through production to product sale.

In addition, supply chain technology can also influence and be influenced by other environmental factors, like social factors. If production process speeds in plants get too fast for the most efficient use of workers, speeds that will induce worker fatigue or other potential dangers to the safety of workers, these can be tracked and identified using supply chain technology. In terms of economic factors, supply chain technology can help veneer firms gather and track pricing data of products sold to certain regions of the world and give an indication of the economic climate of different sourcing and consuming countries. Other technologies even impact supply chain technology in the veneer industry. For example, if a veneer firm purchases a new machine, the supply chain technology must be adapted to fit the production process changes created by this new machine.

In summary, technological advancements external to the veneer, like supply chain technology, can be adapted to be an innovation for the veneer industry as well as a driving force influencing new innovations. Technology can also be impacted positively or negatively by the other STEEP factors, just as well as technology can impact the other STEEP factors.

Economic

The economic expert interviewed for this project was a global economic expert on the wood industry, who provided an overall picture of the entire wood industry from an international scope. The expert attempted to provide information that directly applied to the decorative hardwood veneer industry, and when possible, in Austria.

In terms of sources of supply, the economy impacts the availability of logs and other resources used to produce veneer. There is high demand for a limited resource, which increases the prices for quality logs and thus for the resultant product, veneer. This has influenced the increasing use of substitute products to veneer, like digital printing and laminates, which provide a consistent product at a reduced cost. Because of this, the veneer industry has countered with an attempt to create more consistency in a natural product with dynamic availability of qualities and characteristics. These products are reconstituted veneers, which are an acceptable, consistent natural alternative for many applications.

In terms of methods of production, companies are interested in reducing costs of production in order to maintain a competitive advantage in terms of price on the market. European companies struggle with such issues as longer vacation time for workers and higher wages and benefits paid to workers. The cost structure of companies in Europe is very different

from that of companies in the United States. These things all add into the cost of the final product, so many firms search for cost cutting measures in their production. Slicing veneer thinner is one way firms have tried to achieve that.

Markets for veneered products are very directly related to the economic situation. We currently find ourselves in a global economic crisis. This crisis has impacted the firms in the United States first, beginning with the housing market decline from 2005 onward and further devastated by the financial crisis and subprime mortgage-related issues in 2008. The economic crisis impacted European firms later, in 2009. The demand for many products that use veneer has decreased greatly due to the collapse of the housing market. Products like doors and panels and cabinets and furniture, which all contribute to either the infrastructure or furnishing of a home, have decreased in demand because fewer homes are being built. Even products like automobiles, that use high end decorative veneers, have decreased in demand due to the economic crisis.

However, even before the impacts of the housing crisis had fully taken their toll on markets for wood products, wood products producers were shifting production to lower cost producing countries. For example, many manufacturing firms have shifted their production to Eastern Europe to take advantage of lower wages, and thus lower production costs. And in terms of selling products, which is also relevant in the current economic situation, when demand in local markets decrease companies turn to export markets. In the current economic crisis, there is even a lack of export markets to absorb the excess product. As a result, many firms are going out of business and the industry is reconfiguring itself and waiting for the housing market upswing.

For products and services, the economics of production and costs of supplies as previously mentioned have created a situation where substitute products, including reconstituted veneered products are more acceptable on the market. In addition, the Europeans tend to accept a thinner veneer product than American secondary wood products manufacturers, providing an economic advantage. This also provides an incentive to improve veneer production technology that will accommodate the demand for thinner slices of veneer. Many veneer industry firms cannot bear the costs of research and development that large corporations are capable of. It is particularly important for small firms to conduct market research and small scale new product development in order to remain competitive. And once they have found a market need, to determine if they have the capability to adapt their

production to fit that need. One way firms can do this is to work together with research institutions.

In terms of business models, the current business model for veneer companies, and many other companies within and outside the wood products industry, is survival. Before the economic crisis, economies of scale in production led large corporations to reduce the costs they paid to suppliers. The suppliers of products to secondary wood products manufacturers would have to bear the burden of reducing their costs in order to keep up the demand for their goods to companies who had become their largest customers. Now during the economic crisis, many firms in the industry are struggling for survival.

Ecological

The ecological experts interviewed for this project were from a forest certification organization whose scope is international. Most of the information provided was not specific to the Austrian wood products industry, but some of the information was more specific to the hardwood veneer industry.

Sources of supply of the hardwood veneer industry are greatly impacted by ecological factors of the environment. Veneer species come from many different countries around the world. Forest certification is a process that aims to ensure that forest management, harvesting, and production practices are conducted in a manner that is sustainable. In some countries in the world, like tropical timber producing countries, there are very few sources of certified veneer logs. Veneer companies in Austria are obligated to comply with European Union legislation regarding due diligence to track sourcing of logs to ensure that wood entering the European market is from legal sources. In addition, Austrian firms are obligated to comply with the Convention on International Trade in Endangered Species (CITES) rules regarding importing endangered or rare species. Forest certification is one process that is an acceptable form of due diligence in accordance with European regulations and CITES regulations. If hardwood veneer firms are interested in finding new sources of supply of tropical species, they will need to find a way to ensure that the sources are harvesting timber in a legal fashion and the species are being overexploited or their survival threatened in some way in the countries where they were harvested. This can be costly to prove and may inhibit firms from offering new species or the ability to exploit new sources that could be beneficial to developing countries. However, this can also cause firms to innovate the sources of supply they use for veneer production.

Methods of production are typically not changed as a result of forest certification, except to incorporate the requirements of product tracking. For example, in terms of warehousing, certified forest products need to be kept separate from non-certified products and there needs to be documentation to identify the certified products from the non-certified products. There is the possibility that firms will change their processes as a result of forest certification implementation, and these changes could incite process innovations. However, the experts expressed their belief that forest certification does not greatly impact production method innovation in firms.

In terms of markets, forest certification actually created a new market to appeal to consumers who are cognizant of the unsustainable nature of forest operations in some parts of the world and who are willing to pay more for products to ensure that they come from sustainable, legal sources. Providing certified forest products on markets that have never seen this type of product before is an innovation. Now, any product that can be made with wood can be made from certified wood. The combination of socially conscious consumers and a product offering that appeals to them may open up opportunities for new markets to be created in the future, and is thus an example of how forest certification impacts market innovation in the hardwood veneer industry.

Certified forest products have become a new product or service offering for many firms. Any product that can be made using veneer can be offered in the certified form. New products that appeal to socially conscious consumers may be created as a result of forest certification, which goes hand-in-hand with new market creation. One example of this is a jewelry maker's adoption and use of forest certified woods for jewelry. The jewelry maker's search for certified raw materials created an opportunity in which the jewelry maker learned about different species of wood than they had traditionally used, and thus creation of new products to highlight the natural features of this species.

In terms of business models, it is possible that a change of a company to offer certified forest products provides the opportunity or is actually a change of the firm's business model. It might also provoke a change of the customers or suppliers of the company wanting to offer the certified products. And there are companies, not necessarily in the veneer industry, who have been asked by suppliers and customers to change their business model to obtain chain of custody forest certification. Changing the business model to offer certified forest products

can be considered a revenue business model change, because certified forest products gain higher prices and the firm's costs associated with these products also changes.

Forest certification is an ecological factor of the environment that impacts hardwood veneer industry firms, but it also impacts the other STEEP factors. One of the basic tenets of forest certification is that the system incorporates the social, economic and natural environmental aspects of forests. For example, in terms of economic factors, forest certification has improved the economic situation in some countries in the world by increasing the incomes of parties involved in the management, harvest and production of certified forest products. However, forest certification and chain of custody certification are expensive to implement due in part to the cumbersome process of establishing national standards, auditing the parties that want to obtain forest certification, and creating the documentation that is necessary to prove that each product labeled as certified indeed came from a sustainable, legal source.

In terms of the social impacts of forest certification, the certification process helps create safe working conditions for workers; ensures workers voluntarily work and of legal age to work in the countries in question; and, through promotion as well as sales of certified forest products, improves the livelihoods of people who depend of forests.

In terms of the economic impacts of forest certification, firms that are certified have reported that they have had fewer impacts from the recent economic crisis. This is believed to be a result of the strong recognition of the importance of certification as a sustainable system. A working report detailing the company reports was in draft form at the time of this interview. In addition, firms whose process is certified and who offer certified products have reported higher earnings as a result of certification.

The political impacts of forest certification stem from the very beginning of the concept. Development of the standards for forest certification was accomplished through the collaborative efforts of parties with interests in how forests are managed and used. Once the system was in place, different forest stakeholder groups have sometimes used forest certification politically as a means to accomplish their own goals. The forest certification process is also in accordance with the European Union legislation regarding due diligence to ensure legal sourcing of wood, so it is possible that the number of firms seeking certification will increase as a result of the legislation.

These experts did not believe forest certification had any impacts to the technological factors of the hardwood veneer industry. However, as stated previously, supply chain technology was adapted to incorporate and abide by the principles and criteria set forth by forest certification schemes.

Political

The political expert interviewed for this project was a representative for wood products trade associations at the international level. The respondent was not an expert on the veneer industry, but gave information directly pertinent to the veneer industry in Austria whenever possible.

Currently one of the greatest political impacts to innovation in the sources of supply are in the hardwood veneer industry of Austria is the European Union legislation aiming to ensure that wood entering the European wood products markets is procured from a legal source. This legislation describes the due diligence process that European wood products firms need to perform to ensure they are procuring legal raw materials (Dimas, 2008). It is estimated that only 5% of wood on the European market is of potentially illegal origin (Oliver, 2009), yet veneer firms that want to find new procurement areas or identify new suppliers of raw materials made from wood need to make sure that the supplier is in compliance with this new regulation.

In terms of the political impacts to methods of production, at the European level, there is an organization that identifies the technological state of each branch of the wood products industry and helps to gain funding for research and development to innovate the production processes of wood products industry branches. This organization is called the Forest-based Technology Platform. Many firms in the wood products industry lack the financial resources to improve their methods of production alone, but the Technology Platform can gain partial or whole funding for projects that can create new production processes.

The hardwood veneer industry's search for new markets is somewhat aided by initiatives that market for the industry on a political level. There are organizations within Austria that market for wood as a raw material and there are trade associations that market their industry's products on an international level, sometimes to governing bodies when necessary. In Austria, the organization proHolz campaigns for the entire wood products industry of the

country, while such associations as RealWood for the parquet industry and Initiative Furnier for the veneer industry campaign for their industry branches products.

Product or service innovations by the hardwood veneer industry might be impacted by political initiatives once they are invented and emerge on the market. Some of these impacts might be in the form of position statements regarding emerging products or summarization of product standards.

In terms of new business models, the political arena does not get directly involved in the firms search for them. However, political representation may get involved when business models change to forms that are illegal (i.e. real monopolies) or where state funds are used illegally to change a business model, as in such situations as an expansion.

The political realm is greatly influenced by other environmental factors. Many times the political representatives work with experts from the other environmental areas in order to best influence policy for the wood products industry. For example, political organizations often partner with social initiative and trade union representatives in order to ensure the health and safety of workers in the wood products industry by influencing government policy. They often work together when they have joint positions on an issue. One example is the new legislation regarding sourcing legal timber, which in part, aims to ensure that labor markets in foreign countries are not overexploited or that workers are treated fairly.

Ecological factors of the veneer industry are also impacted by the political arena in that forest certification schemes have aided firms in complying with the legal sourcing of wood products regulation. Global environmental concerns, such as the role of forests in climate change, are also influenced by political representation of the wood products industry. It is interesting to note that older trees, many of which are typically used for veneer production, sequester less carbon than younger trees. Harvest of these trees to be made into products that will store the carbon indefinitely to allow younger trees that will sequester carbon at a higher rate is one way the hardwood veneer industry could be helping to curb the rate of climate change.

In addition, economic factors have also been impacted by the legal wood legislation because compliance with the regulation may cause undue financial burden on firms. The veneer industries of developing countries that can typically outcompete with cheaper production costs will not be imposed by this new regulation, giving another competitive advantage. In

addition, the political initiatives often deal with trade barriers and international trade issues that would affect the economies of countries involved in the trade of wood products.

One very important issue to note is that firms in Austria are obligated to belong to a subject related trade association. For the wood products industry, this is called the Fachverband der Holzindustrie Oesterreichs, and is further subdivided into branches related to sawmilling, wood-based panel production, construction elements (doors, flooring, etc.), furniture production and ski equipment.

Recommendation Development

Data collection as a result of narrative interviewing provided some initial results in terms of the innovation strategies of hardwood veneer industry firms and the environmental impacts to the strategies. In order to understand these data, a SWOT analysis was conducted. Results from the interviews were analyzed for opportunities and threats to innovation. Hardwood veneer industry firms in Austria also currently exhibit two different kinds of innovation strategies: resource-building and regular. The strengths and weaknesses of these two innovation strategy types were also analyzed. As previously mentioned, the qualitative data analysis was aided by the use of NVivo8 software to capture major concepts from the hardwood veneer industry firm management interview narratives and make associations with the interview narratives from the experts in each subject area.

Opportunities

Hardwood veneer industry firms in Austria have the opportunity to create new innovations as a result of the environmental factors impacting them. One of the greatest opportunities for firms in the hardwood veneer industry to improve their innovation strategies is marketing campaigns for hardwood veneer. In Austria, wood products industry trade associations like proHolz aim to increase consumer awareness of the benefits of using wood in general. However, in Germany, a trade association called Initiative Furnier + Natur e.V. is dedicated to the promotion and increased usage specifically of hardwood veneer. Although this organization is explicit to the German market, there are opportunities for increased marketing of veneer in Austria, as well as internationally. The creation of new markets would help to put some firms in the revolutionary innovation strategy category, which would render existing resources and capabilities of other industry firms as well as existing products noncompetitive. Marketing would create huge opportunities for hardwood veneer industry

firms to innovate in all areas of innovation and is an opportunity that should be heavily pursued.

In addition to marketing campaigns, use of political representation to generate awareness on an international level of issues facing the industry could be taken advantage of to improve industry welfare. For example, the role that harvest of large diameter hardwood timber can play to mitigate the effects of climate change could be promoted through political representatives. In addition, the opportunity for firms to gain funding to aid in technological innovation projects through government funded programs is there to be taken advantage of. As well, the wood products firms in Austria are obligated to pay membership dues to the country's wood industry trade association, which could also help to provide members political representation at the international level. Only one firm interviewed discussed being an active member of this trade association, although it was not directly asked to all interview respondents. There are real possibilities for firms to promote the industry that will stimulate the use of hardwood veneer as a raw material in secondary wood products production by informing consumers of the importance of generating demand for veneer.

Also associated to political representation, is the opportunity created by the current European Union legislation regarding the due diligence process for legal procurement of wood entering the European market. As a primary wood products producer in most cases, the hardwood veneer industry is subject to this legislation. In addition, the hardwood veneer industry is an importer of tropical timber, some of which is in question as to the legality of its source. With the prevalent use of supply chain technology to track products through the production process that provides valuable information for decision making at the firm level, most firms will have few investments or changes to make in order to comply with this new regulation. Most hardwood veneer firms need only to ensure proper documentation from their log suppliers that the timber they are purchasing is from legal sources prior to purchase. In terms of consumer perception of the entire wood products industry in Europe, the efforts in this direction can only be positive. In addition, the hardwood veneer industry, which has a great potential for a bad reputation due to its use of the highest quality, largest diameter logs, can benefit from promotion to consumers that this legislation exists and they are abiding by it. Due diligence legislation can be a positive marketing tool for the entire wood products industry, especially the hardwood veneer industry.

One way that producers are already complying with the due diligence legislation is through compliance with forest certification schemes. Forest certification in terms of forest management, for those vertically integrated companies who own forestland that contributes raw materials to their production, as well as chain of custody can also provide companies with a lot of new opportunities for innovation. For starters, one hardwood veneer industry firm interviewed for this study indicated forest certification as a source of supply innovation for their firm, and the experts described how forest certification was an innovation for other firms in the wood products industry. Forest certification has created a new market for wood products complying with the system, companies have developed new products and services as a result of forest certification, and the entire business model of a firm can be changed to fit around forest certified products and production. It was argued whether or not forest certification contributes to production method innovation, but the possibility is there.

However, forest certification is a costly process. In light of the due diligence legislation and the prevalence of the use of supply chain technology in the hardwood veneer industry, there might be an opportunity to reduce the costs of chain of custody certification, for example. If due diligence and product tracking are standard operating procedures in the industry that are regulated in part by the government, there is an opportunity that the costs of chain of custody certification for some firms might be reduced or eliminated entirely.

Another area of opportunity for hardwood veneer firms is the incorporation of externally produced technological advancements and innovations for use in their firms. Some firms have already noted the use of photographic technology, software development, computers, the internet, and supply chain technologies that are not created by their firms. However, the more prevalent use of technologies like RFID and scanning technology is reducing the cost of these products to be more affordable, as well as more user-friendly and applicable to a wider array of potential users. The use of more portable devices in business is an opportunity for added efficiency in veneer companies despite scale or scope. An even greater opportunity for using new technologies in the veneer industry exists when companies get involved with their development or new product testing.

Finally, in terms of manufacturing, there are opportunities to incorporate elements of lean manufacturing into the veneer industry. Though it was not a focus of the interviews conducted, only one discussion about lean manufacturing came up and the firm hadn't even heard of what lean manufacturing was about. Some of the basic principles of lean

manufacturing are already being used in the veneer industry, like single piece flow (with the single piece being the log), kanban cards, and flexible workforce (though these principles may need refinement in order to meet the intentions and objectives of lean manufacturing.) Production methods could be innovated and greater efficiencies in production realized from adopting lean manufacturing.

Threats

The greatest current threat to the global hardwood veneer industry, as well as the entire wood products industry is the global economic crisis. The effects of the financial market meltdown and subprime mortgage crisis in the United States have had repercussions around the world, such as national governments bailing out banks and even countries, as well as downturns in stock markets all over the world. Closer to home, there has been uproar in Europe about the economies of Portugal, Ireland, Greece, and Spain, some of whom were greatly impacted by property bubbles. As the last four countries to come out of recession, with one in particular requiring a Eurozone cash infusion when spending skyrocketed, wood products markets are greatly affected by the lack of consumer spending. With jobs lost, homes lost, and lack of a clear picture of when the crisis conditions will end, consumers either don't have expendable income to purchase many products or are being cautious by saving their money until better financial times are upon us. The whole wood products industry has struggled to stay in business with the global economic climate changing rapidly and detracting severely. Many firms have gone out of business and most have reduced workforces, closed facilities and taken other cost saving measures in order to weather the storm. The economic crisis has been a huge threat to the wood products industry in general, as well as to the hardwood veneer industry.

Consumer demographics are changing around the world and can pose a threat to innovation in the already mature hardwood veneer industry. On June 14, 2010, it was announced that huge deposits of mineral resources like lithium, copper, and gold that would take decades to deplete exist in Afghanistan (AP, 2010). This finding will drastically change the consumer demographic of Afghanistan once the mining commences, because the jobs created by mining in the country will improve the livelihoods of many people in the country. People that previously could not afford certain products will be consuming products of a greater variety and cost. This example is primarily financial, but it is also not known what types of preferences this new consumer group will have. And changes like this are happening all over

the world. The threat this poses is primarily in terms of keeping up with the often unpredictable dynamism of global markets. In terms of product innovation, for example, a company may do market research and determine that a specific market could use a specific new product. The firm could send time, money, and knowledge resources on developing this new product to have this market change on them before new product launch or before the breakeven point after product launch. And though it is important for hardwood veneer firms to pay close attention to consumer demographics and market demands, caution is necessary to avoid the risk that the innovations firms focus on as a result of market research do not meet their demise prematurely.

Another threat to hardwood veneer industry firms is the lack of technological advancements in the production process from external parties. Industry production firms have developed strengths of resiliency to create their own technology, but also networking capabilities to work with companies that can provide them with the resources needed for veneer manufacturing innovations. Though some may argue that this lack of technological progress in veneer machinery is an opportunity for veneer manufacturers to innovate their methods of production, the fact that firms have concentrated their resources on production method innovations as opposed to market innovations is a threat to the entire hardwood veneer industry. It is an allocation of resources to the capabilities to produce a product, which without markets, risks further contraction and reduction of the number of firms to compete with one another. Competition, it should be noted, is a driver of innovation and of general industry progress. Therefore, the lack of technological advancement of the production process is a threat to innovation strategies of industry firms, as well as to the general welfare of the hardwood veneer industry.

Strengths

The strengths provided in this research are not comprehensive to the hardwood veneer industry in Austria. They are simply observations noted from the interviews with top management of firms in the industry. They are described first with reference to the resource-building innovation strategy.

The resource-building innovation strategy is a strategy where firms use new resources and capabilities to appeal to the needs and wants of customers in existing markets. Hardwood veneer industry firms have a propensity for utilizing some of the opportunities that have been presented to them in order to develop new capabilities and find new resources. For example,

industry firms have noted that there is a lack of technological development, mainly with respect to slicing and drying technology. Instead of taking the machinery as is and working with it, firms are changing the existing machines to improve them to work the way they see the machines need to work or even developing new machines themselves. As a result, firms have developed a more intense knowledge of how the machines work with the raw materials. When one firm needed the machines to work in a certain way to develop a new product, they worked with an external partner in order to make that happen. Harwood veneer firms have progressed with resilience when faced with adversity from a lack of technological advancement, which only strengthens their knowledge and competence of producing quality veneer products.

Another strength of the hardwood veneer industry, related to the use of technology, is the application of technological advancements outside the 'normal' veneer production machinery in order to make improvements to the production process or services offered by the firm. Many companies are using the internet, photographic equipment, and even design software now to ease the experience customers have in doing business with them. Posting photographs of veneer online to market their product offerings to customers, and sending customers additional photographs of logs they are interested has eased the burden of traveling to the company to pick veneers. Many customers still prefer to view the veneer in person before purchasing it, but the use of photos and the internet has reduced the amount of time spent by customers watching dozens of bundles they have no interest in purchasing being flipped by workers. Not only is this more efficient for the customer, but it has reduced costs for veneer companies too. Every time a pallet of veneer is moved to show to a customer, cost is added to the veneer. In addition, the use of photographs of veneer in design software sold to architects and designers is an improvement with respect to product awareness of veneer. And while the use of these technologies has not entirely eliminated all of the efficiency problems associated with veneer sales, it has greatly improved the efficiency.

Another area where the hardwood veneer industry has innovated by developing new resources is in reference to the use of new raw materials to create new product variations. For example, firms have found that customers want a more consistent product, like the type of product that laminates can provide. In order to redeem some of that market share and appeal to customers, veneer producers developed products like reconstituted veneers. In order to make these veneers, manufacturers had to think outside the box and change the typical raw material that was commonly used. Instead of using logs, firms had to peel veneer

in plywood type thicknesses, glue the sheets together and slice them. This has eliminated the variation natural characteristics of the veneer create, and offered a more consistent product. Another example of a product that uses the raw material (logs) in a different way is veneer sliced from the ends of logs. Some firms are also slicing lumber or other materials than just logs. The hardwood veneer industry has developed new products by creatively using new raw materials or using existing raw materials in different ways.

One final strength of the resource-building strategy that hardwood veneer industry firms are using is the work companies are doing with outside partners in order to accomplish their goals. Working with software developers, designers, architects, government, research institutions, customers, suppliers and others in order to develop competencies, utilize new resources and realize ideas is a great strength of the hardwood veneer industry.

The regular innovation strategy is a strategy where firms use existing resources and capabilities in order to appeal to the needs and wants of customers in existing markets. One strength of this strategy is that for a firm with limited financial resources, a lot of investment doesn't need to be made in order to create new resources because the firm either has them already or they are available for the firm to purchase. This doesn't mean that the firm is not innovative. It means that the firm has a nimbler approach that doesn't depend on the sometimes cumbersome process of creating new resources and capabilities. The firm can use its competences to innovate in whatever fashion it wants. One great example of this is business model innovation (in any of the three forms: industry, profit or enterprise business models) where the firm innovates by restructuring or reorganizing existing resources and capabilities in a way that has never been seen before by the industry that creates a competitive advantage for the firm.

Another strength of the regular innovation strategy is that new products can be created and the firm doesn't need to venture out into new markets to introduce them. The firm can use its existing capabilities and resources to create new products or services and then use the wisdom it has gained from learning the demands of customers in existing markets. This is a much lower risk strategy than creating a new market or developing new capabilities and resources.

Weaknesses

In the same token, hardwood veneer industry firms in Austria have several weaknesses as a result of the innovation strategies they have chosen. With respect to the resource-building strategy of innovation, firms have focused some of their resources such as time, finances and knowledge in order to develop new machinery and new capabilities, while their products are becoming obsolete and their markets diminishing or disappearing. For example, while reconstituted veneers were being developed, the technology for digital printing and using laminates in new applications was improved and achieved, thereby further diminishing the market share for natural veneer. This may not be a direct trade off, yet it is definitely a weakness of the hardwood veneer industry.

In very much the same token, firms innovating using the resource-building innovation strategy have also made a trade-off of their internal capabilities for a lack of familiarity and association of the customers' and markets' needs. Markets change and consumer preferences change. When firms spend expend their resources focusing on the things they determine they can change, they fall farther out of touch with the things they cannot change. Half of the firms interviewed did not even make market innovation a goal. And in very much the same token, three out of the four firms interviewed for this study made product and service innovation a goal, and two of these firms utilized a resource-building innovation strategy. But if firms are intending to deliver these new products and services to the same customers and the same markets, the risk of cannibalizing the market share of their own products is very real and apparent.

There are also weaknesses of the regular innovation strategy in use by hardwood veneer industry firms. The most obvious weakness is that this firm is not putting itself in a position to outcompete other firms in the veneer industry, it simply exists. By not exploring beyond the comforts of the existing capabilities and resources or existing customers and markets, while the rest of the firms in the hardwood veneer industry are creating new resources and capabilities in order to be more competitive, this firm runs the risk of becoming obsolete to the industry and going extinct.

Another weakness of the regular innovation strategy is the dependence on existing resources, like raw materials, that may become harder to procure or more expensive to source. This reliance on externalities creates a situation where the firm is inflexible to change to use new resources or develop new capabilities, especially if change needs to be made quickly. A

different way to state this might be that the firm has an almost completely emergent strategy as opposed to those firms who are more deliberate than emergent in their attempts to innovate. This veneer firm is left weak and vulnerable to whatever changes may happen in the industry, as opposed to making changes happen and taking control of their destiny.

In addition to the interview results, a hypothetical model of innovation in the hardwood veneer industry in Austria was created. The model suggests that the traditional role of the firm's business model as a control mechanism for the products that flow through the supply chain, from procurement of raw materials, to production processes, to final sale of veneered products holds true. However, the nature of the environmental factors is different from the previous model in that the factors are not distinct elements that have no interaction. It was determined from expert interviews that these factors do indeed interact and influence one another both positively and negatively. The environmental factors have all been found to impact each area of innovation. It is hypothesized that these factors form a sort of network or matrix within which the hardwood veneer firm must attempt to innovate in each of the five areas proposed by Schumpeter. This model is depicted in Figure 3.

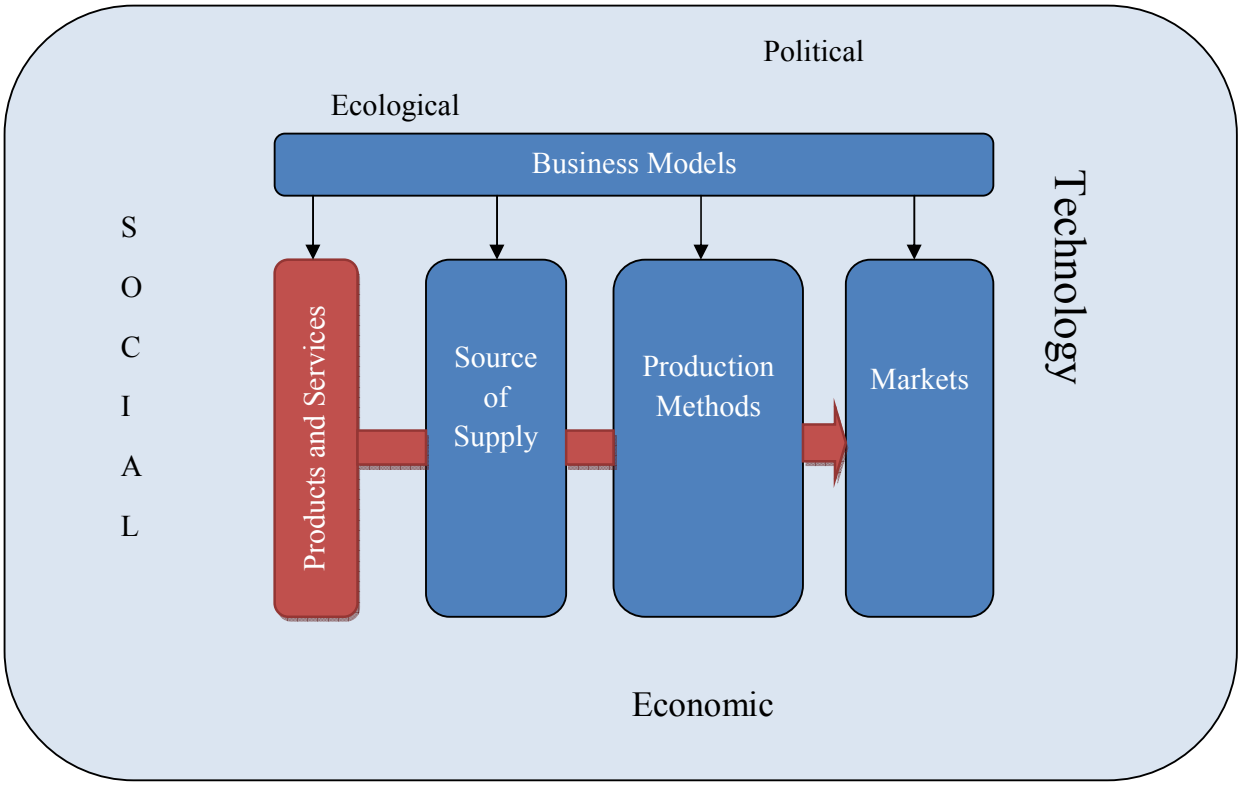

Figure 3: Hypothetical Model of Environmental Impacts to Innovation

Recommendations

The following recommendations are based on the SWOT analysis results and are general industry recommendations. More specific recommendations will be provided to each company upon completion of this research project that will aim to help companies improve their innovation strategies under the influence of the environmental factors identified.

1) Make it a goal to innovate. In nearly half of the responses from interviewees of this project claimed it was a goal of their firm to innovate in a particular area of innovation. It is very clear that companies in the industry will not be innovative or take advantage of new opportunities for innovation if they do not make it a goal and a focus to do so.

2) Shift innovation area focus toward market innovation. The hardwood veneer industry has done a great job of creatively developing new products and services to meet the needs of customers in existing markets. However, now is the time to use that creativity to deliver these new product and services to entirely new markets where veneer has never been used in the past.

3) Get informed and active in the secondary environment. As identified in this project, there are great impacts of the STEEP environment beyond a firm's immediate competitive environment (i.e. customers, competitors, suppliers, etc.). By being at large, hardwood veneer industry firms have less of a chance of being able to recognize great impacts to their innovation as well as being able to do something about it than if the company was more involved in the STEEP environment.

VII. Discussion/Conclusions

The hardwood veneer industry of Austria is an innovative industry that is both positively and adversely impacted by the environmental conditions within which they work. Characterized as a member of the second largest industry in the country, the hardwood veneer industry in Austria is actually small in comparison to neighboring country Germany, as well as to the United States. Almost half of the veneer industry firms in Austria were interviewed for this study to provide insight as to how they innovate and to the impacts of that innovation. Many firms had difficulty with identifying factors beyond the industry customers, suppliers and competitors that might be impacting their innovation. Some top managers even questioned as to whether or not their firms innovated at all.

Still, some interesting insights have been uncovered as a result of this research project. First of all, Schumpeter's five areas of innovation (namely, sources of supply, methods of production, markets, products and services and business models) are present and are being innovated by hardwood veneer industry firms in Austria. Veneer industry firms have a tendency to view their businesses in terms of their supply chain, where products and services are flowing through the procurement, production and sales departments. The business model is the mechanism conducting the activities of each area of the business. In terms of innovation, firms are trying to add value that will give them a competitive advantage in those five areas.

A second interesting result of this research is the innovation strategies in use by the industry, as well as each firm's view of the innovation strategy they strive for. Most firms are striving for the radical strategy that will give them an unbeatable competitive advantage over competitor firms. Their attempts are only partially successful, and the recommendations developed through this research should help them realize how to get there. One firm, however, is trying to be like its competitors, but is falling short by only innovating with the resources/capabilities and customers/markets that it knows. This research may help them realize where they are and where they are headed in order to be more innovative.

The environmental factors impacting the industry are not a comprehensive list, but a list of the most critical or the ones most evident of having an impact on Austrian firms. Some of the focus of these environmental factors was beyond the borders of Austria to the whole of Europe. In future iterations of this research project, some of the issues within Austria may come to light. Although, in a global industry like the hardwood veneer industry, with logs being imported for production from different places within and outside of Europe and different market hotspots in various places around the continent, it is imperative that the firms in a country make sure to look beyond their borders to examine a broader viewpoint of the working environment impacting them.

In terms of how environmental factors impact innovation strategies, the obvious distinctions are positively, adversely, or not at all. The positive impacts could be considered opportunities, the adverse impacts could be considered threats, and the factors with a neutral impact could be considered a threat or an opportunity, depending on the situation or even the company in question. The impacts noted from interviews with company management and

environmental experts for each of the environmental factors explored in this research are summarized in the following paragraphs.

The current situation finds economic environmental factors having the greatest perceived impact on the firms of the hardwood veneer industry. Given the global nature of the industry and the global nature of the economic crisis, this is of little surprise. However, future census survey results will give a measure for how detrimental this impact really was to all firms in the industry. Theorists on the environmental factors typically describe technology as being the quickest to change, yet as described by experts and industry firms, this economic crisis seemed to rapidly change the way they do business or if they do business at all. It was also noted that innovation research during this tumultuous period is well timed to determine if some of Schumpeter's theories hold true.

Technology or the lack of technological development has provided industry firms with the opportunity to innovate their production processes, often times in combination with product or service innovations. However, firms should continue to adopt externally produced technologies as they become affordable and specifically useful to the veneer industry. Working with technology firms, both internal and external to the veneer industry will be a mutually beneficial endeavor for the hardwood veneer industry to pursue in the future. In addition, working with universities, as some firms have done, would be another way to ensure that technological progression of the industry is kept proprietary.

Forest certification was one of the most often cited ecological impacts to innovation by veneer firms interviewed. Though it is argued between industry and experts as to whether or not forest certification was a factor impacting production method innovation, it was suggested as impacting innovation in each of the other four areas. Implementing forest certification could be a new opportunity for firms that have not already done so, though some may view the changes and financial means needed to implement forest certification as adversely impacting their firms.

Social factors of the environment were not often recognized as a factor impacting innovation in the hardwood veneer industry. It is possible that the social environmental impacts have been overshadowed by the current strains imposed by the economic environment, but further research needs to be done to determine if this is the case. The social and economic environments seem to be highly associated factors of the environment, as do social and political factors.

The political impacts to innovation seem to be the least recognized of the five STEEP factors. Most firms did not even recognize political factors as impacting their firms. However, some of the political impacts are positive impacts that can be considered opportunities for the industry to continue innovating. It is important for firms to get involved in their political environment and contribute to the discussions of issues impacting or potentially impacting them.

Another interesting discovery was that the environmental factors had a tendency to impact one another. Interviews of experts in each of the environmental areas brought this information to light. Future research on the hardwood veneer industry could produce a more apparent picture of how the environmental factors interact and impact one another, and what that means for industry firms. Insights into whether this is a dynamic or static process would also be interesting to determine.

Several hypotheses were developed during the current research endeavor that will aim to be explored in future research work. In terms of the hardwood veneer industry in Austria that will be explored via survey research, one hypothesis is that environmental factors impact firms in the following order, from greatest to least: economic, technological, ecological, social and political. The survey will quantify factors within each of the environmental areas, but will also allow firms to offer suggestions as to additional factors impacting them as well as a ranking for the additional factors.

Due to the Austrian and American scope of this project, another hypothesis is that the environmental factors impacting firms in the United States are similar to the factors that impact Austrian hardwood veneer industry firms. Some of the factors are already international in scope, such as forest certification and the economic crisis. Other factors, like the due diligence legislation and some of the social/trade union factors might be slightly different.

While it is difficult to make hypotheses comparing the Austrian veneer industry to that of the United States without first completing the interviews in the United States, some evidence exists that the environmental factors are impacting Austrian companies to a different degree than American firms. In addition, due to the nature of the interaction of environmental factors with one another, the combined effects of environmental factors (like the economic crisis and forest certification, for example) might be different in Austria than the United States.

Additional hypotheses will be created upon completion of interviews of United States veneer firm management and environmental experts. One hypothesis will address the most prevalent type of innovation in hardwood veneer firms in Austria and the United States. Other hypotheses will be created from the initial qualitative data analysis of interview transcripts.

As described previously in this paper, the results presented in this work are part of a larger study on environmental impacts to innovation in the hardwood veneer industry. Future work that needs to be accomplished includes gathering quantitative data from survey research on the Austrian hardwood veneer industry. In addition, the same methods need to be applied to the hardwood veneer industry firms in the United States. The results of this research will be disseminated individually to participating firms and experts, as well as disseminated and published to the broader scientific community and forest industry as scientific journal articles, trade journal articles, and a Doctor of Philosophy dissertation. The Marshall Plan Scholarship will post an interim work on their website to highlight the Austrian veneer industry. The results will also be presented at trade industry meetings and scientific conventions, such as the Forest Products Society 64th International Convention in Madison, WI.

In conclusion, the hardwood veneer industry is experiencing the mature industry situation in its lifecycle and in order to bring it out of this dire situation, innovation is needed in five main areas: products and services, sources of supply, methods of production, markets, and business models. Firms can use four different innovation strategies to combine these five areas into unbeatable returns when measured on continuums of market/customer and capabilities/resources: regular, niche, resource-building and revolutionary innovation strategies. The environment firms in the hardwood veneer industry of Austria are facing is dynamic and uncertain in five main areas: political, economic, technological, social and ecological. Factors in these five areas impact innovation in ways that will be measured in the future of this research project.

Future research in the hardwood veneer industry was proposed by this research. However, it is believed that similar methods to those used in this work can be used to determine the innovation strategies used by other wood products industry firms as well as firms in other industries. These methods may also be used to determine the environmental factors impacting innovation in those respective industries. It is not improbable that the same factors impacting the hardwood veneer industry are impacting other wood products industry firms as

well. Future research could also focus on how competitor firms to the wood products are innovating in each of the five areas identified by Schumpeter, and whether or not the same environmental factors are impacting them. This would provide some insight into how the wood products industry, namely the hardwood veneer industry could be more innovative in a way that would create a competitive advantage over competitor industries.

VIII. Appendices

D. 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)

E. 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)

F. 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?

G. 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?

H. Illustrative Designs Linking Qualitative and Quantitative Data

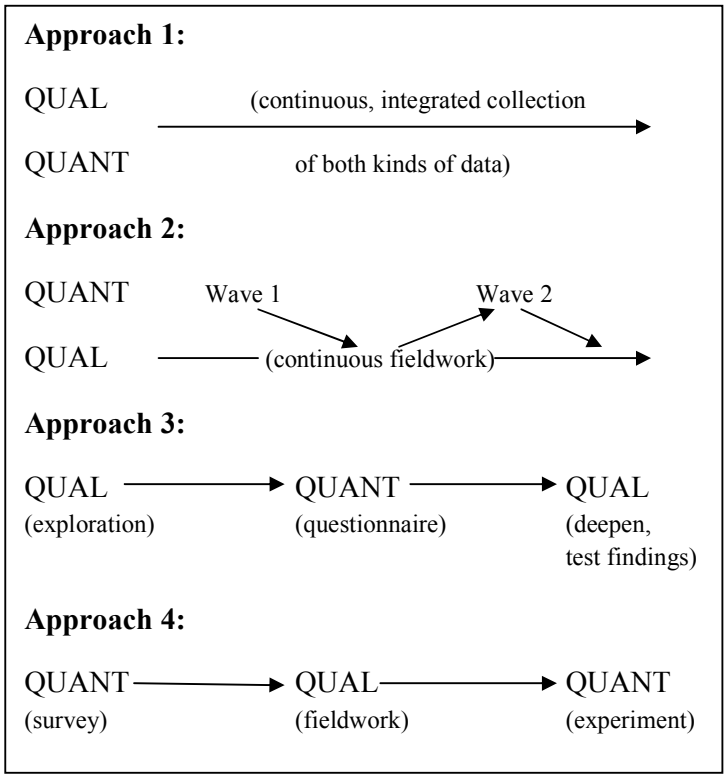

Figure 5: Illustrative Designs Linking Qualitative and Quantitative Data
SOURCE: (Miles and Huberman, 1994)

I. *Researcher Resume and Qualifications for Conducting Research*

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Career Objective

Strategic business management position that utilizes my forestry field knowledge, forest products and business coursework, and research experience to aid and promote the long-term success of a forest products industry firm. Eventually, forest products business management and marketing tenured faculty position at an accredited university.

Education

Virginia Tech University, Blacksburg, Virginia **Aug 2007 - Present**
Doctor of Philosophy degree in Wood Science and Forest Products expected in 2011
Dissertation topic: Innovation strategy improvement in the hardwood veneer industry
Master of Business Administration degree from Pamplin College expected in 2011, GPA 3.77

University of Wisconsin-Madison **Aug 1999 – May 2004**
Bachelor of Science in Forest Science, Academic Dean's List, Cumulative GPA 3.081

International Experience

Marshall Plan Scholarship, Salzburg, Austria **May 2009 – Aug 2009**
Doctoral research collaboration with Salzburg University of Applied Sciences in Kuchl, Austria

Danzer Fellowship Program, Reutlingen, Germany **Sept 2004 – July 2005**
Coursework for Master of Business Administration at Reutlingen University of Applied Sciences
Tours of veneer production, sales, and customer facilities in Europe and North America

Academic Year in Freiburg, Freiburg, Germany **Sept 2001 – July 2002**
Forestry field studies in Germany and France

Research Activities

Virginia Tech University Graduate Research Assistant **Aug 2007 – Present**

- Coordinate forest industry research projects on veneer grading, and technology transfer
- Collaborate with industry partners to collect data, including handling proprietary data
- Write reports on research findings for scholarly journals and industry publications

University of Wisconsin-Madison Undergraduate Research Assistant
Jan 2001-Aug 2004

- Co-authored article on private foresters involvement in cross-boundary forestry practices
  Rickenbach, M., and Jahnke, A.D. (2006) Wisconsin Private Sector Foresters' Involvement in Nonindustrial Private Forestland Cross-boundary Forestry Practices. *Nor. J. of Applied For.* 23(2): 100-105.
- Updated and published Managed Forest Tax Law and Wisconsin State Nursery Directory for UW-Extension
- Conducted wood fiber mat market research for USDA Forest Service Forest Products Lab
- Assisted graduate student researchers on ecological projects in laboratory and boreal forest areas of Canada

Professional Organizations

Forest Products Society	Member	**Aug 2007-Present**
Xi Sigma Pi –Alpha Nu Chapter	Lifetime Member	**May 2003-Present**
Society of American Foresters	Member	**Jan 2002-Present**
University of Wisconsin-Madison Forestry Club		**Aug 2000- May 2004**

Vice President (2002-2003), President (2003-2004), Undergraduate Representative (2003-2004), Student Council Representative (2003-2004)

Scholarly Achievements

Wisconsin Agricultural and Life Sciences Alumni Association Outstanding Sophomore Award	Apr 2001
Wisconsin Agricultural and Life Sciences Alumni Association Senior Award	May 2004
Upper Midwest Forestry Capstone Competition Winner	July 2004

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