

INNOVATION ACTIVITIES IN THE PRIMARY WOOD PRODUCTS SECTOR: A CASE STUDY

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Abstract. The goal of this article is to understand how wood products industries located in Virginia incorporate innovation into their business processes through a case study methodology. Based on innovation theory and previous studies in innovation, a case study that included interviews, on-site visits, and analysis of documents was designed and applied to four industries in the wood primary sector to 1) identify innovation activities into four categories: product, process, marketing, and organizational management; and 2) to understand, describe, and explain the source of innovation in these firms and to develop an innovation research model for further research. All four firms performed innovation activities mostly at the product development level and the source of innovation is primarily from external sources. Using the results, a conceptual model to further study innovation in the primary wood products sector was defined. This model will be tested using a different methodology in subsequent research. The application of the case study was very useful to understand the source of innovation and how primary wood products firms perform innovative activities at various levels.

Keywords: Innovation, Competitiveness, Manufacturing, wood products.

INTRODUCTION

The study of innovation in the US has been limited to the quantification of inputs of the innovation process rather than outcomes of the innovation process, innovation performance, and the relationship between innovation performance and company performance (Schramm 2008; Andrew et al 2009). In the case of the wood products industries, a few innovation studies have been undertaken. For example, Crespell and Hansen (2008) studied the relationship between work climate and innovativeness in a small wood products company. They found that organizational commitment and job satisfaction show positive and significant correlations within a climate of innovation. In another study, Wan and Bullard (2008) determined the relationship among firm size, competitive forces, and financial performance in the furniture industry in the US. This research found that smaller companies were more likely than larger ones to introduce new inventions and innovation. A study by Ellefson et al (2010) identified investments in product research and development by the public, private, and

government wood products sectors. Results showed that paper product companies are the leaders in research and development investments as a percentage of sales (1.39%) followed by the primary wood sector (0.85%) and the furniture sector (0.79%). The study also mentions that the value for all manufacturing industries in the US is 4.0%. There also have been innovation studies in the wood products industry for non-US countries (Cao and Hansen 2006). They studied recent development and measurements of innovation in the Chinese furniture industry using a combination of qualitative and quantitative methods. Results indicate that Chinese industries in this sector are pursuing innovation with equal focus on product, process, and business systems. Cao and Hansen also found that innovation is correlated with competitiveness and company size, later confirmed by Wan and Bullard (2008). The research findings suggest that larger firms that become leaders in innovation may increase the overall competitiveness of the industry.

One of the first studies on innovation attempting to classify innovation activities was performed by Hovgaard and Hansen (2004). By studying 17 forest products firms in Alaska and Oregon,

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the authors classified innovation activities of these firms into product, process, or business systems activities. Respondents also identified unique products or processes as the most common way for them to define innovation.

From the previous research, it is clear that the study of innovation and its measurements is in the early stages of development in the wood products industry as well as other business sectors.

This study has a goal to explore and understand how a selected group of wood products industries practice innovation activities in their business processes. The outcomes of this study will help to better understand the source and impact of innovation in overall business performance. With these outcomes, an innovation research model will be developed as a research framework for upcoming quantitative research.

LITERATURE REVIEW

Although today's global economy has been classified as innovation-based, it was previously labeled as a high-technology economy and as a manufacturing-based economy before that (Situngkir 2009). Business organizations today are performing on a different stage. Knowledge has become the most important driver and is developed through innovation. There are many definitions and classifications for innovation. For example, the Organization for Economic Cooperation and Development (OECD 2005) defined innovation as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organizations, or external relations." Schramm (2008) defines innovation as "the design, invention, development, and/or implementation of new or altered products, services, processes, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm."

Innovation is any significant improvement at the product, process, organizational structure or

marketing level as stated by the OECD (2005). Morris (2006) promotes a definition where innovation can be classified in four similar ways according to the degree of development within the organization: incremental innovations; product and technology breakthroughs; business model innovations; and new ventures. Business model innovation is particularly interesting because this is the stage of innovation where a business organization is poised to create new products and develop new or better processes. In addition, the organization is capable of delivering and supporting their products or services so that their customers are better satisfied. Another way to see innovation is from a capability point of view. On this concept, Christensen (2001) points out that managers who are interested in initiating an innovation process might be limited by the capabilities of their resources, processes, and values. These results are very valuable for the business organizations that are thinking of incorporating innovation as one of their core processes. Managers can increase the likelihood of successfully implementing innovations in their organizations by knowing exactly what innovation framework is necessary in terms of resources, processes, and values.

Metcalf and Ramlogan (2008) state that innovation is an economic act that relies on new perceptions of market opportunities, and, as D'Cruz and Rugman (1992) states, competitiveness can be defined as the ability of a firm to design, produce, and/or market products superior to those offered by competitors when considering price and nonprice qualities.

Another important concept when studying the theory of innovation is the relationship of innovation with other core business processes and the performance of the organization. According to Srivardhana and Pawlowski (2007) and Jaruzelski and Dehoff (2008), business organizations invest millions of dollars to support their innovation activities, but their innovation processes and their outcomes are still not well understood (SciSIP 2008). Business organizations make these investments because they know

there is value in improving their products and processes, although little is known about the underlying relationships of the innovation process, business processes, process performance, customer satisfaction, or associated information technologies that facilitate the innovation process (Hertog and Gjalt 2007; Vega-Jurado et al 2008a). Schramm (2008) also indicated that innovation measurements should extend beyond simply measuring inputs such as spending on research and development and that it is necessary to establish clear mechanisms to track and measure outcomes of the innovation process to fully determine the impact of innovation on the economy. Andrew et al (2009) stated that US firms have trouble measuring innovation because they are unsure what to measure, lack the information they need, and doubt that measurement efforts will prove purposeful.

METHODOLOGY

A case study methodology was designed to collect data from four primary wood products manufacturing sites. By using multiple cases, the results can be used to increase the robustness of the theory being tested (Stake 1995). The idea of using a case study methodology is to generalize to the theory, not the population (Tellis 1997). Also, case studies can be used to satisfy the three tenets of the qualitative method: describing, understanding, and explaining (Yin 1994). Case study (qualitative research) has been chosen for this study because innovation in the wood products industry has not been researched in detail and it is a concept that still needs to be better understood to conduct quantitative research.

For this study, a detailed analysis using interviews, on-site visits, and document analysis was performed for four different types of primary wood processing plants (hardwood sawmill, softwood sawmill, hardwood flooring, and housing systems solutions). The reasons to choose industries in the primary wood products sector are as follows: 1) out of the three wood products manufacturing sectors (paper, primary, and sec-

ondary), the primary sector has been ranked as the lowest innovative wood products sector (Andrew et al (2009); 2) the chosen subsectors represent the majority of primary wood industry establishments in the state of Virginia; 3) the four selected companies are considered innovative firms in their sector based on visits to more than 30 wood products industries in Virginia; 4) their financial performance over the last 5 yr has been very positive; and 5) they were very enthusiastic to be part of this study.

A descriptive case study was used for this research with the purpose of comparing innovation theories with actual innovation practices in the selected firms.

Innovation And Innovative Firm

According to the OECD (2005), innovation is defined to be “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.” From this broad definition, four main innovation activities can be distinguished: product, process, marketing, and organizational innovation.

Product innovation is a new or significantly improved product with respect to its characteristics or intended uses. This might include significant improvements in technical specifications, materials, and ease of use or other similar characteristics. Process innovation refers to improved techniques, software, or equipment used in the process that leads to significantly improved production or shipping methods. Marketing innovation refers to any new improvements in product design, packaging, promotion, placement, or pricing technique for a given product. Finally, organization innovation can be categorized by improvements to reduce organizational costs, increase worker satisfaction levels, more access to on-the-job training, or reduction of the cost of supplies.

A firm can, therefore, be classified as innovative if it has had innovation activities (product,

process, marketing, or organizational activities) during a certain period of analysis regardless of the success of those activities. The technological knowledge required to perform such innovation activities could come from different sources according to Vega-Jurado et al (2008b). According to this classification (Fig 1), firms considered supplier-based might acquire technological knowledge through the acquisition of machinery, patents, or software. Other firms might acquire knowledge through the development of their own research and developmental internal activities or from partnerships with universities or public institutions. This second group is classified as science-based firms.

Design and Application of an Interview Tool

Based on the previous definition of innovation and innovative firms, a survey was designed as a tool to distinguish the wood products firms in Virginia that align with innovation theories as described by the OECD (2005). The tool has the following sections.

- Demographics and general information: Number of employees, sales per year, type of products

produced, markets, and size of manufacturing operations were asked of every site.

- The Innovation Concept: In this section, every firm in the study was asked the following aspects:
 - Interpretation of the word innovation;
 - Number of new products or product enhancements introduced in the last 3 yr;
 - Number of new processes or process enhancements introduced in the last 3 yr;
 - Number of new marketing or marketing enhancement activities introduced in the last 3 yr;
 - Number of new or enhanced organizational activities introduced in the last 3 yr; and
 - Ratio of expenses from innovation activities to total sales for the last yr’s budget.
- Strengths, weaknesses, opportunities, and threats (SWOT) analysis: Every firm was asked to mention at least two specific items in each category. This analysis helps to better understand internal and external factors that might be affecting the firm’s performance in the short and long term.

To apply the survey to collect data for the case study, a phone call was made to the selected facility to schedule an appointment with the

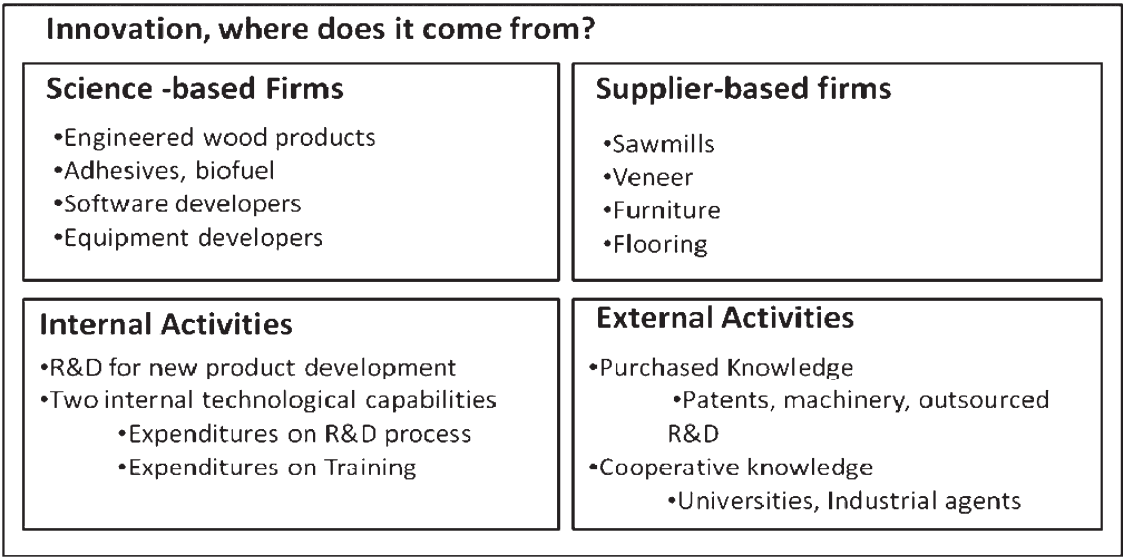


Figure 1. Technological knowledge sources to develop innovation activities (Vega-Juradoet al 2008b).

highest company representative available. The interviews took between 45 min and 2 h. At the end of the interview, a plant tour was taken to better understand the manufacturing processes of each firm.

Data Analysis

As previously indicated, case study research is not research with random sampling, but rather it is a specific selection of the cases that would help to maximize results in the learning expectations during the period of available time for the study (Stake 1995). To examine the relationships between variables to facilitate analyses of collected data, Miles and Huberman (1984) recommended analytical techniques such as rearranging the arrays, placing the evidence in a matrix of categories, creating flowcharts or data displays, tabulating the frequency of different events, using means and variances, and cross-tabulation. For this article, a description of innovative practices, frequency tabulation, and a comparison matrix of activities were used to compare and describe the theory. The information collected was used to further validate results from the literature and to develop a research model as suggested by Yin (1994).

RESULTS

In this section, the results of the interviews, on-site visits, and documentation analysis are presented. The source of innovation is identified for each firm, the type of innovation found in every firm is presented, and the impact of innovation in the overall business performance is also discussed. Table 1 shows the demographics of the firms used as cases in this study. The largest firm achieved \$100M in sales for 2008 and employed 225. The smallest firm in this group employed 72 and sold \$12M for the same year.

Innovation Activities in a Hardwood Sawmill

This company started in 1948 as a fabricator of wooden fish boxes and later developed into a

Table 1. Demographics of selected manufacturing sites.

Type of firm	Total employees	Main product	Main raw material
Hardwood sawmill	225	Kiln-dried hardwoods	White oak
Hardwood flooring	140	Unfinished strip	Red oak
Softwood sawmill	72	Decking	Yellow pine
Housing solutions	105	Roof/floor trusses	Yellow pine

sawmill, pallet, and pressure-treated lumber manufacturing operation. Today the company still operates its core business and also is developing a biomass operation.

The business environment for hardwood sawmills has been severely impacted by the slow sales in the housing sector in the US. Government reports continue to indicate that many hardwood lumber producers have gone into financial distress, and in some cases, firms had decreased capacity or shut down their manufacturing sites. Hardwood lumber producers that have survived and continue to be competitive, as in this case, have mentioned that innovations in product development and process improvement have given them an edge to remain in business. As the housing market slowly shows signs of recovering, this particular hardwood lumber producer believes that there are strong opportunities in green building construction and woody biomass energy production.

As indicated previously, this firm has developed important innovations that have kept the company as a competitor in its business sector. Although lumber production continues to be the most important business, the company has diversified its product offerings in response to new market needs and trends. As an example, the firm invested in technology to produce finger-jointed lumber, bagged shavings, and wooden pellets. These product development innovations have opened new niche markets in the green building, animal farm bedding, and energy sectors. In this case, this firm has sustained a competitive advantage thanks to

their own development of certain new critical products in response to a market demand. Although the company has had the capacity to create new products (internal activities), it has also acquired technology from suppliers (external activities) to support its product development process. Also, the firm has developed a sound marketing strategy in response to new trends and needs from current consumers (green building and energy savings). The firm has committed to develop new products from its core production line that can respond to these consumers' needs.

The impact of these innovation practices has been positive in the firm's overall performance, in accordance with the firm's perception. The firm's sales were steady from 2006 to 2008 with no loss of market share. Pallets, animal bedding products, and engineering products such as finger-jointed lumber have positioned the company ahead of their competitors.

Innovation Activities in a Softwood Sawmill

The manufacturing process of softwood lumber is similar to the hardwood lumber manufacturing process. Main variations are related to lumber grading systems, treatment processes, and drying process. Softwood lumber is mainly used for construction of residential housing in applications such as framing, decks, or outdoor furniture.

Softwood lumber products are considered a true commodity where the main competitive factor comes from cost and customer service strategies. Softwood lumber producers have had a very difficult time during the last 5 yr because of the sinking of the housing sector in the US, their main market. Over this period of time, many softwood lumber manufacturing firms have decreased capacity or completely shut down operations, even more drastically than hardwood lumber producers. Only those softwood lumber producers that have developed new products or increased customer service have continued to survive and perhaps grow a little.

The softwood lumber sawmill in this case study is a local firm in Virginia that employed over 72 in 2008 with decking products as their number one selling product. The main business strategy for this company has been to provide excellent customer service to compete in a true commodity market. The sales and marketing team dedicate extra time to accommodate requests from their most important customers. However, the firm realized that in a market driven by cost, customer service was not enough and the company started looking for alternative products and process improvements to help reduce cost. Early in 2006, the company started partnering with a Canadian company with a long tradition in the horse bedding sector. Under this partnership, the softwood lumber producer started a new production line dedicated to producing bagged shavings for horse bedding. Also, in 2008, the company decided that to remain cost-competitive, better sawmilling technology was required. Hence, the company installed a new gang-rip process to increase material yield, decrease process time, and increase the quality of the lumber.

Similar to the case of the hardwood lumber producer, this firm used internal activities to develop a new product in response to an increased demand in horse bedding products. The firm knew the entry barriers to this niche market were high so it initiated a partnership with a well-established firm in the horse bedding business to avoid entry barriers and quickly start to profit from the new product. Today this softwood lumber producer continues to produce decking products as their core business, but the new product (horse bedding chips) has helped the firm to maintain revenues and compensate for the loss of sales in the decking market. Also, with the addition of new sawmill technology, the company has been able to improve its overall decking product with faster delivery, lower cost, and increased quality.

Innovation Activities at a Hardwood Flooring Manufacturer

This particular hardwood flooring company uses mainly red and white oak as raw materials. The

firm's main products are unsealed, sealed, and prefinished strip flooring. The company started in 2006 as a family-owned business and in 2008 employed close to 100. The management has a long tradition in the hardwood flooring business. Today the company looks forward to having an organizational transformation into how to incorporate the new family generation into the business management. The firm has been very successful since its creation and although the housing market (the main firm's economic driver) has been decreasing, the firm's overall performance is excellent.

As indicated earlier, the firm has been very successful since its creation. A large part of this success has been the incorporation of several innovation practices as described previously. First, the company's management team has a long tradition in the hardwood flooring manufacturing sector, and second, the firm has invested time and resources in finding out what product improvements can be made to better meet customer demands. For example, the production line has little "work in progress" accumulation and important changes have been made to offer product features such as different materials, flooring finishes, or special features (eg unbeveled flooring). Another important innovation practice is the commitment of the organization to keep their production employees updated in the different technologies, processes, and new trends in the hardwood flooring manufacturing business. It is important to mention that the firm is concerned that many of these process innovations can be easily copied by other competitors so the company is committed to remain one step ahead of their competitors.

Innovation Knowledge Transfer in a Housing System Solutions Manufacturer

This company provides, as main products, housing system solutions such as roof and floor trusses, wall panels, and interior and exterior doors. The company's sales in 2008 were 18% down compared with 2007. This decrease in sales is just a reflection of the overall situation in the

housing market, as indicated by the firm's representative. The company produces a large variety of products, in most cases customized housing solutions. Orders are taken mostly from construction companies or individual architects. There are times when customers come directly to the company and the firm will provide an architect to help the customer design their project. This project could be an entire new home or remodeling project. When the customer requirements are determined, the design department will produce blueprints, and the production order is generated and sent to the manufacturing floor. On the manufacturing floor, there are different production lines for each type of product: wall systems and roof and truss manufacturing. The house components could be shipped to the construction site at once or as they are finished on the manufacturing floor. All other house components such as flooring, exterior wall siding, electrical, windows, doors, plumbing, etc, are provided by a third supplier that works very closely with the firm. In the past, the firm had exported to Europe, Asia, and South America with great success. The company no longer exports but is looking forward to creating an export market.

Despite the decreasing demand for new homes, the company has found a niche market in customers looking for green building solutions. This niche market has challenged the company in adapting their business model to this new trend. For instance, the company has sent its employees to get certified in green building initiatives, and new suppliers that hold green building initiative certifications have been incorporated in the supply chain. The firm also has created a showroom where new customers can see how the final elements will look in service. This showroom has been an important decision concept to show the firm's products' functionality and also to market the firm's products.

As the company's representative has indicated, the flexibility and high knowledge of its employees are the firm's largest factors and these critical success factors have been properly tightened up with the opportunities in green building construction. In the near future, the

firm would like to come back to international sales, especially because some housing markets such as Western Europe and Asian countries (India, Japan, and United Arab Emirates) are becoming very sensitive to green building initiatives. Also, the company is conscious that their marketing efforts need to be redesigned and perhaps have a little more work-team philosophy so that the overall performance goals can be achieved more easily.

Comparing Innovation Activities by Type of Firm

As indicated in the literature review, innovation might occur in any of the following dimensions: product development, process improvement, markets development, and organizational management. Firms in this study were asked to mention the most important innovation activities they have performed during the last 3 yr. Table 2 shows such innovation activities classified into four categories (as indicated in the literature review) and by type of industry. Results show that the most innovative firm developed nine innovation activities during the last 3 yr and four of the nine innovation activities were classified as marketing development activities. The softwood sawmill lumber mentioned the fewest innovations activities with only four: two at the product level and two at the process level. In total, the firms in this case were able to identify 27 innovation activities 2006-2009.

Most of the innovation activities were classified as new product development (37%), second was process improvement (33%), third was new marketing development activities (26%), and last was organizational management (only

13%). Similar results were found by Hovgaard and Hansen (2004) and Cao and Hansen (2006). The majority of the innovation activities at the product level were oriented to improve the characteristics of existing products and only in two cases they were related to the creation of new products (finger-jointed lumber and horse bedding shavings). In terms of innovation activities at the process level, the focus was on the acquisition of equipment or software to become more productive (gang-rip sawmill, molding technology) or improvements to existing equipment. These findings led us to believe that primary wood products industries obtain most of the innovation from transferring knowledge from suppliers (supplier-based) than creating that knowledge in internal activities (science-based).

Table 2 also shows that altogether the firms identified seven marketing development activities, the hardwood flooring manufacturer with the highest level of innovation marketing activities. Results also indicated that organizational management activities resulted in the smallest number of innovation activities with only one activity. In this area, all companies mentioned training as an innovative practice in organizational management, but giving training is not considered a true innovation and is not accounted for.

Table 3 shows the most important innovation practices categorized by innovation area, company, and source. The softwood mill is pursuing three innovative practices through external sources. The hardwood flooring company is the only firm in this case study developing an innovative activity in organizational management. This firm sees this as a challenge in today's firm

Table 2. Number of innovation activities indicated by participating companies.

Group	Innovation activities				Total	Frequency
	Product	Process	Marketing	Organization		
Hardwood sawmill	3	3	0	0	6	22%
Hardwood flooring	2	2	4	1	6	22%
Softwood sawmill	2	2	1	0	8	30%
Housing solutions	3	2	2	0	7	26%
Total	10	9	7	1	27	
Frequency	37%	33%	26%	4%		

Table 3. Selection of best innovative activities by firm and innovation area.

Firm	Product development	Process improvement	Organizational management	Marketing
Hardwood sawmill	Finger jointed lumber (external), bagged shavings (internal), pellets (external)	Computer controlled edgers (external)	Did not mention	Modular decking market (internal)
Softwood sawmill	Bagged shaving (internal)	Pulp wood shaving process (external)	Did not mention	Horse bedding market (external)
Hardwood flooring	Stained prefinished (internal), no bevel flooring (internal)	Material handling system (external)	Prepare new family generation to manage firm	No bevel flooring market (internal)
House systems solutions	Green building products (internal), use of iLEVEL products (external)	Recycling of short pieces (internal)	Did not mention	Green building market (internal), international markets (internal)

structures where family-managed businesses have become very rare. However, they would like to keep the business as a family-operated one. All firms show innovative activities in the creation of new markets. In all cases, the innovative marketing activities are internal, except for the softwood sawmill. The company recognized that it was much better to develop this market through a partner because of high entry barriers.

Discussion and Innovation Framework

As mentioned in the literature review, a firm can get its innovation from internal or external sources. Results from this case study show that the studied firms obtained their innovation mostly from external rather than internal activities. Developing a process in research and development to create innovation within the firm does not seem to be a common practice for the wood products companies in this research. This case study has helped to understand the source of innovation of four wood products firms from the primary sector. In all cases, companies reported to have acquired innovation through external activities such as buying equipment, patents, or hiring external organizations to train their employees. However also it was found that some of the firms developed and executed internal activities to pursue innovation. For example, the softwood sawmill and the housing system solutions firms indicated that cooperation with

universities and government organizations is a good way to internally develop innovations, although this does not happen as often as desired.

The case study was also useful to understand in what innovation areas the firms are focusing their efforts. Firms indicated at least one activity in every one of the four innovation areas as described in the literature. However, no strategic direction was detected in selecting areas for innovation and the categorization in those areas seems to be more casual than strategic. Specifically, most of the innovation activities fall into the categories of new product development and process improvement. These firms seem to understand that creating and launching a new product could bring a competitive advantage. Also, in a commodity market such as hardwood and softwood lumber production, process improvements could help to decrease cost and provide some competitive advantages as well. This might suggest comparing them with other industries, but the lack of innovation measurements across different industries is a limitation for achieving such comparison.

The four firms did not know how to define innovation when they were asked for a definition. Previous research indicates that innovation is not as well understood in the US, especially when firms are asked how innovation outputs are related to economic development (Schramm 2008; Andrew et al 2009). Results from this

research fall into these previous findings. However, it seems that the case study firms know that there is a positive impact of innovation in the company, but none of the companies formally measure that impact. As an example, all the firms in the study were unable to quantify the ratio of expenses in innovation activities to sales or the impact of the innovation activities to the overall firms' performance. This also leads to the belief that the innovation process in these firms is not straightforward. There are many internal and external elements that must fall into place for a company to be considered a high-level innovator.

The SWOT analysis (Fig 2) helped to understand the internal and external variables or elements that the firms in this study might need to address to become better competitors or innovators. In all cases, the SWOT analysis revealed that there was little relationship between strategic direction and the implementation of some of the innovation activities described here. For instance the hardwood flooring manufacturer is the firm with the highest number of marketing activities, however the firm does not see marketing as a strength (Fig 2). Another example of this disconnection between strategy and the implementation of innovation activities is the human resource factor. The softwood sawmill indicated that people are its most important strength, but the firm did not mention any organizational management activity such as training.

Based on the findings from this case study and the literature review, the model shown in Fig 3 has been drawn to further investigate innovation in the wood products industries but on a larger scale. The performance of the innovation process will have a positive impact in the firm's value added processes (Hypothesis 1), but the performance of the innovation process might be negatively affected by external variables such as government regulations and the economy in general (Hypothesis 2). Innovation performance is also positively impacted by the source of innovation that could come either from internal activities (Hypotheses 3) or external activities (Hypothesis 4). The company performance will positively impact the firm's customer satisfaction levels (Hypothesis 5), and the value-added processes will positively impact the firm's performance (Hypothesis 6).

The proposed model will help to understand how a larger sample of wood products industries in the primary sector is pursuing innovation. This will permit us to generalize results into the population and propose concrete actions to this industry sector.

CONCLUSIONS

This case study was designed to describe, understand, and explain how four wood products companies in the primary industry sector are pursuing innovation activities. Four firms located in

Firm	Strenghts		Weaknesses		Threats		Opportunities	
Housing systems solutions	Flexibility	Technical knowledge	Marketing	Teamwork	large competitors cutting prices	Economy	Exporting markets	Regional customers in NC, SC, PA
Hardwood sawmill	Hard work	Quality, and now innovation	Not integrated effort within	Urgency factor	timber price	Customers going out of business	Alternate use of by-products as chips,	Outlets for "clear" lumber
Softwood sawmill	People	Quality	Management replacement	Better knowledge in drying	Lack of good loggers	Policy, government	Increase markets for exports	Synergy of new people
Hardwood flooring manufacturer	Family business	Continuous improvement	Spread too thin	Cash flow needs	Competitors will start copying	Lumber supply	Wine additives	Prefinished market

Figure 2. Strengths, weaknesses, opportunities, and threat analysis.

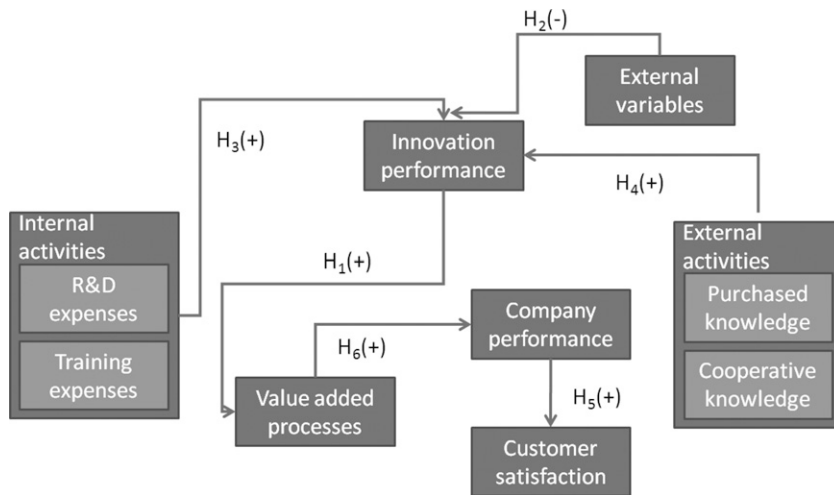


Figure 3. Innovation model developed from the case study and literature review.

Virginia were carefully selected for the study. An on-site visit to each company was organized to interview the general manager or the owner of the company. Innovation activities were identified and classified according to the four areas of innovation as described in the literature. Companies were also asked about the source of innovation for all the practices. Although companies could not properly define innovation, they all agreed that innovation has a positive impact on the firm's value-added processes and the firm's overall performance. The positive impact of innovation according to all four firms was also related to customer satisfaction. The innovation practices or activities were classified as internal or external activities. This was important to compare with the literature and to understand the source of innovation. It was found that firms such as the hardwood flooring manufacturing and the housing systems solutions firms generate most of the innovation activities from internal sources. The others seem to rely more on external sources (eg suppliers and acquisition of patents) to pursue innovation practices.

These results allowed us to create an innovation model and further investigate innovation in this industry sector. This model will help practitioners and academicians to generalize some of the results over a larger sample and to formulate

strategic actions that can help the industry to become more competitive.

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