

# The Role of Innovation in the Forest Products Industry

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ABSTRACT

The US forest products industry has lost several hundred thousand jobs over recent years. It is argued that low-cost, foreign competition is largely responsible for this loss. Given this situation, enhancing innovation is increasingly seen as a path to competitive advantage and improved financial performance. Strategies have been and are being developed at the state and national level in the United States as well as the national level in many other countries. Although there is general recognition that innovation can positively impact competitiveness in the industry, there is little research verifying this relationship. This article discusses current innovation research focusing on the forest products industry. It also provides a brief example of a competitor nation's (Finland) efforts to enhance innovation in its forest products industry. With this background, the potential roles in enhancing innovation in the US forest products industry of company executives, policymakers, and researchers/educators are outlined. For example, it is recommended that companies concentrate on creating more innovation-centric cultures and policymakers are encouraged to support the future forest products industry workforce. Finally, it is suggested that the research and education community can be more effective in supporting industry through industry-focused research and developing skills of current and future employees.

**Keywords:** forest products industry, innovation, competitiveness

The current housing and industry downturn has stolen headlines from the general US forest industry attrition that has happened over the past several years. Between 1999 and 2006 wood product manufacturing, paper manufacturing, and furniture and related product manufacturing lost approximately 52,000, 147,000, and 109,000 jobs, respectively (US Census Bureau 2002, 2009). Some of this loss is caused by consolidation and productivity improvements, but in many cases foreign competition has been a primary culprit (e.g.,

LaBissoniere and Bowe 2006, Buehlmann et al. 2007).

The US furniture industry provides a good example of the influence of foreign competition. According to the US International Trade Administration (ITA), during the years of 1999–2006, imports of furniture from China into the United States increased 4.3 times, or an annual rate of nearly 24% (ITA 2009). In 2003, an antidumping petition was filed with the US International Trade Commission and the US Department of Commerce against Chinese manufactur-

ers of wooden bedroom furniture. Despite efforts to limit Chinese imports, many US companies were still unable to compete, contributing to the job losses outlined previously.

This information paints a picture of an industry in retreat, but not all sectors have had the same experience. The wooden cabinet industry has largely weathered the storm of foreign competition. Between 1999 and 2006 this industry sector added over 38,000 employees and nearly doubled its value of shipments (US Census Bureau 2002, 2009). Effective mass customization, a way companies are able to quickly deliver products that more closely match consumer demand, thus differentiating themselves from foreign competition, has been suggested as a key difference between the cabinet industry and the furniture industry (Lihra et al. 2008).

As policymakers in developed economies have watched the rise of manufacturing in developing countries and the loss of competitiveness in their own domestic industries, there has been an escalation of interest in the potential for innovation to counteract the loss of global competitiveness and increase profitability (e.g., Bullard and West 2002, Andrew et al. 2007). This interest has been focused by national-level recognition

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of the importance of innovation and the idea that during the past 25 years the United States has been effective in optimizing efficiency and quality but in the next 25 years society must be optimized around innovation (National Innovation Initiative [NII] 2004).

Oregon, Maine, and other states have recently completed major efforts assessing the state of their forest industries (e.g., Hovee 2004). In Oregon this resulted in creation of the Oregon Wood Innovation Center, a part of the Department of Wood Science and Engineering at Oregon State University, designed to improve the competitiveness of Oregon's wood products industry by fostering innovation in products, processes, and business systems. The state has also undergone an extensive planning process led by four state agencies: Oregon Department of Forestry (ODF), Oregon Forest Resources Institute, Oregon Business Development Department, and Oregon State University to develop a forest cluster economic development strategy with a stated goal to create and maintain a favorable investment climate for environmentally sensitive, socially responsible, and globally competitive forest-based businesses throughout Oregon. As a result, these businesses will generate high quality, value-added products; family wage, highly skilled employment; increased revenues to private landowners for providing public benefits and increase forest products exports (ODF 2008).

The strategy has three primary elements with forest cluster vitality focusing on increasing research and development and improving Oregon's forest sector innovation system as important actions needed.

At the national level, the industry, through the Agenda 2020 Alliance (Agenda 2020), has teamed with the Department of Energy and the American Forest and Paper Association to develop the Forest Products Industry Technology Roadmap. The Roadmap focuses on seven areas:

1. Advancing the forest "biorefinery."
2. Sustainable forest productivity.
3. Breakthrough manufacturing technologies.
4. Advancing the wood products revolution.
5. Next-generation fiber recovery and usage.
6. Positively impacting the environment.
7. Technologically advanced workforce.

The strategy is quite technical in its orientation but clearly subscribes to the notion that innovation is critical to future competitiveness.

It is perceived by many industry observers that the US forest products industry faces a significant challenge with respect to maintaining its competitiveness into the future. This explains the current policy momentum in many states focused on enhancing innovation. The remainder of this article summarizes current research findings regarding innovation in the forest products industry; examines Finland, as an example of how another country is facing the challenge; and contemplates appropriate roles for industry executives, policymakers, and researchers/academics in creating an innovative industry.

### Forest Products Industry Research Findings

Common beliefs and experts suggest that innovation is the key to competitiveness, but the forest products industry literature provides limited evidence of this relationship (Knowles et al. 2008a). Most innovation research focusing on the forest products industry has been published in the last 5 years. Generally, results of this research are similar to findings spanning a broad array of industries suggesting that there are three primary areas of innovation: product, process, and business systems (Hovgaard and Hansen 2004, Hansen et al. 2007). Product innovation results from new product development (NPD) efforts as well as continuous, incremental improvement of existing products. Process innovation refers to improving manufacturing processes, typically for the purpose of increased throughput and conversion efficiency with an ultimate goal of reducing costs. Finally, business systems innovations are improvements in the way a company manages its business operations. A simple example of this would be a switch from geographic sales territories to national accounts management. A more complex example would be a shift in business model as envisioned by the NII that sees manufacturers becoming system integrators that manage supply chains and no longer the traditional, single enterprise (NII 2004).

Overall, forest products industry managers do not see their companies as particularly innovative, but companies have been found to consistently focus on process innovation (Schaan and Anderson 2002a, Cre-

spell et al. 2006, Hansen 2006b, Knowles et al. 2008a). This is true of primary and secondary firms. Large companies are, overall, more innovative, suggesting that resources and higher levels of networking increase the ability to be innovative (Crespell et al. 2008, Stendahl and Roos 2008). Other evidence shows that large companies tend to focus on process innovation (Crespell et al. 2006, Wagner and Hansen 2005) while smaller companies use a more balanced innovation portfolio (Wagner and Hansen 2005), assumedly recognizing that successfully competing with large companies through process innovation is unlikely.

Research across industries has consistently shown that NPD is critical for long-term competitiveness (Cooper 2001). Forest products industry companies with more structured NPD processes tend to be more successful in bringing new products to market (Crespell et al. 2006), but few forest products industry firms have structured NPD processes (Hansen 2006b). Larger companies are more likely to have structured processes and corporations have a more structured approach than independent mills (Hansen 2006a). Generally, the industry is weakest with respect to employing marketing-related NPD tools. A clearly defined product concept and strength of project leader have a positive impact on product development success while firm size and education level among managers are significantly related to successful NPD activity (Stendahl and Roos 2008, Stendahl 2009). Contrary to evidence from other sectors of the industry, Bumgardner et al.'s (2001) findings suggest a relatively systematic approach to NPD by large furniture companies.

With respect to North American sawmills, performance in the form of sales growth is positively correlated with the propensity to create and adopt products, processes, and business systems, but results are mixed with indications that both a focus on process innovativeness and a balanced innovativeness focus have the strongest impacts on firm performance (Knowles et al. 2008a, 2008b). Finally, across forest industry sectors, financial performance is influenced by product and process innovativeness (Crespell and Hansen 2008). Secondary manufacturers appear better able than primary manufacturers to turn innovativeness into improved financial performance (Välämäki et al. 2004, Crespell and Hansen 2008).

Managers see company culture as key to

facilitating innovativeness (Hansen et al. 2007). A culture that encourages innovativeness is described as being part of the “lifestyle” or “mindset” within a company. A company culture supportive of collective learning and an understanding of the marketplace are important core competencies (Bull and Ferguson 2006). Market orientation is often seen as part of company culture. This orientation promotes innovativeness in a firm (Crespell et al. 2006) via a close focus on customers and competitors. A market orientation is important because product innovations based on a “resource push” are not as successful as those based on “market pull” (Bull and Ferguson 2006).” Company climate includes the attitudes and behaviors that are characteristic of the way of doing things within an organization and is an element of its culture. Climate has a direct impact on innovativeness as well as an indirect impact on company performance via innovativeness (Crespell and Hansen 2008).

The “wrong” kind of culture can be detrimental. Lack of priority, lack of slack resources (time and money), low knowledge, lean centralized organizations, and a traditional culture all create barriers to innovation within forest products industry companies (Korhonen 2006, Hansen et al. 2007, Stendahl and Roos 2008). Managers see company tradition and resistance to change as major hurdles to innovation. Especially problematic is the traditional production orientation of many companies (Hansen et al. 2007). If the metrics by which personnel are rewarded are based on volume recovery, that is exactly what they will focus on. This links directly to the finding that process innovation is the most prevalent type of innovation in the industry.

Innovation research in Europe has been heavily focused on “systems of innovation.” The innovation system concept focuses on the idea that the linkages among actors and institutions within a nation, region, or sector heavily influence innovation progress. The complex relationships among these actors, their knowledge creation, and the technologies they use impact the development of innovation throughout the system (Organization for Economic Co-operation and Development 1997). Therefore, rather than concentrating on individual organizations, researchers take a larger view of the interactions among a host of actors and institutions (Kubeczko and Rametsteiner 2002, Kubeczko et al. 2006). Only limited research in this vein has been conducted specific to the for-

est products industry; however, the concept is important in developing an understanding of how to create a more innovative forest products industry.

The limited research results specifically conducted with forest products industry companies available today provide some evidence that becoming more innovative would benefit the forest products industry. Still, there is much refinement needed to develop a sufficient understanding of the dynamics of innovation and firm performance. As industry executives, policymakers, and researchers/academics ponder the path forward, it is important to learn from the experiences of other forested regions.

### What Can Be Learned from Finland?

In the forest products industry, Finland is typically perceived to be an innovator. Productivity statistics suggest some truth to this perception. For example, with respect to wood products manufacturing, multifactor productivity improvement in Finland and the United States between 1987 and 2006 was 1.17 and 0.3%, respectively (Statistics Finland 2009a, US Bureau of Labor Statistics 2009). Comparing countries is difficult at best and there are many differences between the industries in Finland and the United States. Accordingly, the following is not meant as a direct comparison or as specific actions US industry should take, but rather an example to learn from. Finland has recently focused on enhancing innovation across its economy and the forest products industry has developed its own innovation focus.

Finland began a special focus on innovation in the mid-1990s in response to an economic recession after the demise of the Soviet Union. In the early 1990s, unemployment in Finland went from 3 to 20% and gross domestic product (GDP) shrank approximately 10% (Ahlbäck 2005). In response to the crisis, the country began focusing on enhancing innovation in key industry clusters. One part of the strategy was increased investment in research and development (R&D). In 1991, R&D as a percentage of GDP stood at 2%. By 2007 this value had increased to 3.5% adding over €4.5 billion to annual R&D investment in the country (Statistics Finland 2009b). The US value for R&D as a percent of GDP is 2.6% (National Science Foundation [NSF] 2008).

Some claim that success in innovation can not be linked exclusively to technological infrastructure, but is tied intimately to the social fabric of the societal context (Lundvall 2007), suggesting that countries such as Finland have an inherent advantage based on a long tradition of cooperation among the citizenry. This culture is in sharp contrast to the independent, pioneer spirit that is typically associated with the United States.

The Finnish forest cluster focused its R&D through a program called the Finnish Forest Cluster Research Program Wood Wisdom (Halme et al. 2008), an effort designed to increase competitiveness of both forestry and the forest products industry through research and cooperation along the value chain. A number of follow-on initiatives have been implemented. Examples include the Wood Material Science Research Program, in cooperation with Sweden, and, most recently, an even wider cooperation of eight European countries in WoodWisdom Net. These have served to create a stronger network of researchers and practitioners (Halme et al. 2008).

Partly because of these efforts, Finland has played a vital role in the internationalization of the European forest products industry and in the initiation of the European Forest-based Technology Platform (EU FTP; Halme et al. 2008). European Technology Platforms (ETP) are European Union-facilitated, private-public partnerships that provide a framework for defining sector R&D priorities via a multistakeholder process (ETP 2009). The FTP is designed to increase the competitiveness of Europe’s forest products industry through developing innovative products and services. The FTP resulted from work of a broad coalition of industry stakeholders that developed a vision targeting the year 2030. From this, strategic objectives were identified and a strategic research agenda was created. There are five strategic objectives in the FTP applied across five different value chains (e.g., pulp and paper products). Strategic objective 1 is, “Development of innovative products for changing markets and customer needs.” As an illustration of the forward thinking contained in the objectives, the description within the research area “Living With Wood” reads, “... with the appropriate solutions, wood and wood-based systems can even take into account that owners’ and users’ expectations can change over the lifespan of the product (Anonymous 2006).” Think of the move-up home that a 40-some-

thing couple with two kids moves into and how that house might be designed to change as the kids leave home and the couple retires and, eventually, faces old age. The EU FTP has many similarities with the US Forest Products Industry Technology Roadmap, but can be described as more market and consumer focused than the US effort.

Policy in Europe tends to focus on innovation systems and attempts to facilitate innovation through managing the national, regional, and sectoral innovation systems. In this respect, Finnish companies have support from a national system of innovation that has identified the forest products industry as an industry cluster of national importance. The EU FTP focuses on the sectoral innovation system. Finnish forest products industry companies, the Finnish Forest Research Institute, the Technical Research Center of Finland, and four Finnish universities have created a new innovation company, Forest Cluster, Ltd., The role of this company is to initiate and facilitate research and innovation programs and channel research funds with an overall goal to, "... become the strongest innovation environment of the branch globally (Forest Cluster 2008)." Clearly, the Finns are betting on innovation for the long haul. Given the upside potential of enhanced innovation to the long-term health of an industry, forest products industry stakeholders should periodically assess the current status of the industry with respect to innovation and strategically consider future efforts.

## Recommendations for the Future

The European (Anonymous 2006) forest products industry recognizes the importance of a healthy innovation system. Current thinking regarding systems of innovation refers to innovation ecosystems (NII 2004) hinting at both complexity and interdependence among the many organizations involved. Careful analysis of the strengths and weaknesses of the US innovation system, especially with respect to how it supports (or fails to support) the forest products industry is needed. Better understanding of the current system can lead to a better vision for future competitiveness and each member of the system can better implement its roles and responsibilities. The following text outlines potential directions forward for indus-

try, policymakers, and researchers/educators.

## Industry

At the very heart of the innovation quandary is culture and many forest products industry companies would benefit from more innovation-centric cultures. Executives across industries claim that a risk-averse culture prevents their companies from achieving higher returns on innovation (Andrew et al. 2007). For those firms that are unable to compete based on low costs and process innovation, a commodity-focused, production-oriented culture is insufficient. As emphasized by national experts, "Companies should strive to develop innovation-enhancing cultures and offer programs that enhance innovation (NII 2004)." In the author's past research, managers often observe the challenges with cultures in forest products industry companies. As stated by a past research participant and forest products industry executive,

They [the forest industry] are light years behind other industries in this area [innovation] and need a reality check. The only way to change any of this is by bringing in management from other industries that know how to develop and implement an innovation based strategy . . . I have yet to see this person . . . just more of the same good old boy approach which keeps the industry spinning in circles. **US Manager** (Hansen et al. 2007)

To be effective at innovation, companies must actively practice innovation management. This starts with Boards of Directors that emphasize this necessity (NII 2004) and fully rests on the shoulders of the executive management team. Beyond the normal "lead by example" requisite, the team must establish an innovation strategy supported by metrics that guide company personnel in being innovative and creating innovations. As one past interviewee described the situation,

[The] sawmilling industry has always been able to measure one thing, that's cubic meters and then you have it divided by hours or days or markets. . . . Nowadays a big breakthrough coming into the picture also in our company, we started thinking Euros. But still we need the help of the cubic meter measure next to the Euro measure so that the old and new people can see, what does it mean? **European Manager** (Hansen et al. 2007)

Often, forest products industry companies are running so lean that personnel do not have the time to invest in innovation. Historically, some of the most innovative

companies provide slack time for personnel to pursue innovation projects (e.g., 3M). Research and development can happen in many ways beyond the traditional in-house laboratory. Networking and cooperating with other companies up and down the supply chain is critical. Some aspects of R&D can be outsourced, e.g., to commercial and government laboratories.

Managers should carefully monitor what is happening with university research. This not only provides insights into new developments, but can be an important source of networking. Oregon provides a good example of general forest products industry support for university research. In Oregon, the industry has long supported a harvest tax that funds, among other things, university research. In 2007 the Oregon State University Forest Research Lab received over \$2.8 million in harvest tax revenues. This money supports research that has direct impacts for industry operations. Examples include formaldehyde-free adhesives in the hardwood plywood sector and adaptation of forest operations during the transition from old-growth to second-growth timber in Oregon.

## Policymakers

Recent experience in Oregon suggests that policymakers often need to be reminded of the economic importance of the forest products industry. In Oregon it is not uncommon in policy forums to hear statements along the lines of, "... now that the forest industry is gone ..." This is despite the fact that the forest products industry is the second largest traded sector in the state. Policymakers are key members of the innovation system so it is critical that they have a full appreciation for the contributions of the forest products industry to the economy and the necessity of a finely tuned forest products industry innovation system.

An often cited example of a weakness in the current innovation system is an inadequate supply of skilled employees. This is despite the fact that virtually all university forest products and wood science degree programs are undersubscribed. Well-placed student incentives could help fill this gap and presents a prime opportunity for joint industry/government initiatives. As an example, the Oregon Forest Resources Institute sponsors a program called Careers in Forestry focused on high school students. It is offered statewide and designed to attract young people into forest products industry

careers. Although the program is too new to judge outcomes, this is a good example of cooperation designed to benefit the entire forest products industry in Oregon. General support from policymakers for the innovation system that supports the forest products industry is always needed.

### Researchers/Educators

There is not an extensive body of innovation literature specific to the forest products industry and researchers must continue to develop new knowledge in this area. To best enhance industry practices, competitiveness, and profits, there are three particular areas that deserve further attention: culture, innovation portfolio, and NPD.

A traditional culture and commodity mentality are significant hurdles to innovation in forest products industry companies. Research addressing how companies can manage culture change and avoid the commodity mentality trap is badly needed. For example, can attracting talented managers from nonrelated industries help a company alter its culture or is this more likely to solidify resistance from the old guard? Documenting examples of companies that have successfully shifted gears to a higher focus on innovation is needed. Researchers should consider whether this might come from other natural resources-based industries.

Most of the existing research shows a forest products industry that is process innovation focused. Although not fully consistent, considerable evidence suggests that process innovation has the strongest empirical link with firm performance. Insight into the innovation portfolio that is best in specific product and market contexts is needed. Some evidence suggests that a balanced portfolio of innovation provides the best performance. Researchers must develop a better understanding of what situations are suited to a strategy of developing new products versus focusing on new business models or improving production efficiency.

Many companies in the industry must become better at developing new products. Because forest products industry companies typically fail to implement a systematic NPD process, examples of companies that have developed effective NPD systems, either within the industry or in other, similar industries, would be beneficial. Any number of projects investigating the hurdles to NPD could be beneficial for the industry as it seeks to deliver new products to the market.

Although there is considerable room for

additional research insights specific to the forest products industry, there is a huge body of knowledge from the general innovation literature that can significantly benefit forest products industry companies. As suggested by Stendahl (2009), what is especially lacking from the academy is practical advice on how to manage for innovation and effectively develop new products. In other words, the academy must do a better job of technology transfer, thus providing executives with decisionmaking currency. Ideally, every refereed article should have a companion piece designed specifically for application by managers. In addition, there is a clear need for improved personnel skills within the forest products industry specific to innovation and NPD. This translates to an opportunity to design and offer continuing education in this badly needed skill area.

The education community has a responsibility to produce innovation-savvy graduates that arrive in the workplace with the appropriate mentality and tools to help their employers innovate. Many undergraduate curricula have a capstone course designed so that students can use the diverse set of skills and knowledge they have acquired during their studies. The University of Idaho has a year-long capstone course that centers on developing new products and processes. Recent examples include commercial firelogs from bluegrass straw and Ohmic heating as an alternative to wood staining. This is an example of the sort of education that can provide innovation-savvy new employees that are valuable to the 21st century forest products industry.

### Conclusions

Innovation represents a potential path to competitive advantage for US forest products industry firms. There are important roles for all stakeholders and they must work together to assure a healthy innovation ecosystem that can efficiently foster competitiveness. Without a sustained effort to enhance innovation in the industry, continued disinvestment and attrition of our manufacturing infrastructure can be expected.

What is the role of innovation in the future forest products industry? The importance of innovation is recognized at the state (e.g., Oregon), national (e.g., Agenda 2020 Alliance), and supranational levels (e.g., EU FTP). Many competitor nations are actively pursuing innovation-focused strategies. Although the evidence does not create a clear picture of the role and impact of innovation,

at a minimum, the current situation is one where innovation will be necessary to maintain pace with the competition.

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