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*Article*

# Innovation Insights from North American Forest Sector Research: A Literature Review

**Eric Hansen [1,*], Erlend Nybakk [2] and Rajat Panwar [3]**

[1] Department of Wood Science and Engineering, College of Forestry, Oregon State University, 119 Richardson Hall, Corvallis 97331, OR, USA

[2] Norwegian Forest and Landscape Institute, Postbox 115, 1431 Ås, Norway; E-Mail: nye@skogoglandskap.no

[3] Northland College, Ashland 54806, WI, USA; E-Mail: rpanwar@northland.edu

* Author to whom correspondence should be addressed; E-Mail: Eric.Hansen@oregonstate.edu; Tel.: +1-541-737-4240.

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**Abstract:** The promise of increased industry competitiveness through innovation has driven interest in innovation by industry managers, policy makers and academicians. Forest sector researchers have produced a strong body of work in recent years. This article provides a review of work originating in North America during the period 2000–2013. The review includes 28 journal articles focused on the forest sector in the U.S. and Canada. Seven important themes from the literature are identified and discussed: defining innovation and innovativeness; measuring innovativeness; factors influencing innovativeness; new product development; climate/culture; innovation systems; and innovativeness and firm performance. The positive culture and climate within a company has a clear connection to improved innovativeness and firm performance. Generally, findings describing the culture of the forest sector show a conservative group that fails to sufficiently invest in innovativeness and innovation. Culture change presents a significant opportunity within the industry to strive toward the improved development of new products, processes and business systems to reap the rewards of improved performance. The implications for managers and researchers are outlined.

**Keywords:** innovation; innovativeness; forest industry; forest sector

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## 1. Introduction

Schumpeter [1], one of the most influential economists of the last century, saw technological innovation as a new product/service or a new production process, and the strategic advantages and increased performance this led to for a company. Soon after a new product, service or production process was invented; the entrepreneur would have a strategic advantage that lasted until someone else developed something new and better. This strategic advantage gave the entrepreneur a "monopoly profit" until new innovations entered the market. When a new innovation had gained a "monopoly profit" position, it then became the target of new innovations, and the cycle began again. A new creation eliminated the old product in the marketplace, something Schumpeter called "creative destruction".

Subsequent to Schumpeter's [1] work, innovation theory has become an established research field. However, despite the large body of research on innovation, no unified definition for innovation or innovativeness exists [2]. Some of the most common ways to describe innovations are a radical, semi-radical or incremental [3,4] product, process, administrative, technical [4], architectural and component [3]. Furthermore, innovation research is a broad field, but can be categorized according to its antecedents; the individual level, the organizational level, the inter-organizational level and the institutional/regional level [5].

Significant bodies of academic work specific to the forest sector have developed in Europe and North America. Antecedents and barriers to innovation in the wood industry have been investigated in Sweden [6]. In Finland, a lack of slack resources, lean centralized organizational designs and an inward communication climate hinder organizational renewal in major forest industry companies [7]. Norwegian findings suggest that an innovation strategy, innovative working climate, learning orientation and innovativeness positively affect economic performance [8,9]. However, much of the European work has been conducted within the systems of innovation research approach [10], while that in North America has been predominately focused on organizational innovativeness [11,12]. One synthesis paper exists that provides a picture of the situation globally as of 2005 [13], but this is now nearly a decade old. In addition, much of the existing innovation-focused, forest sector work has been published since 2005 with very few examples prior to 2000. This article endeavors to provide a synthesis of research findings specific to the North American forest sector for the years 2000–2013. By isolating our work to one geographic region, we attempt to control for major institutional and cultural differences that impact innovation and innovativeness. For example, in many countries, the forest sector is strongly influenced or owned by the public sector or remains in transition to a full market economy. Our objective in this work is to capture key themes in the research stream focused on innovation and innovativeness.

Below, we outline the selection criteria for the inclusion of articles in this review. This is followed by a discussion of important themes in innovation research specific to the North American forest sector. Finally, we outline implications for managers and for researchers, focused on the apparent gaps in current innovation work.

## 2. Methods

For this review, we target empirical innovation studies that focus primarily on the North American forest sector and are published in refereed journals. We used the following rules for selecting articles:

- We conducted an EBSCOhost, an article database provided by EBSCO Industries, Inc., search of all refereed articles from 2000 through 2013 using the following key words in various combinations connected to the titles of articles: forest industry, wood industry, innovation and innovativeness.
- We added any articles that the authors were aware of that did not appear in the EBSCO search
- We then used the literature cited sections of everything identified through Steps 1 and 2.
- Finally, we kept only those articles that were empirical in nature, focusing primarily on the North American forest sector. As mentioned previously, this narrow focus allowed us to control for major institutional and cultural differences.

This scheme meant excluding synthesis articles, such as Hansen and Bull [14], and articles on the global industry, such as Ghosal and Nair-Reichert [15]. Our database of identified articles includes 28 refereed articles.

After carefully reviewing the findings in each of the 28 articles, we identified seven themes that encapsulate the key findings across studies. The process of identifying themes was subjective, based on the judgment of the authors. However, it was systematic through an iterative approach and consensus among authors highly familiar with the innovation management and forest sector innovation literatures. This is not to suggest that we present a fully comprehensive summary of all study findings, but have captured the key themes and commonalities. The text that follows outlines the seven themes by first giving a short introduction to the area, based on the general literature. This short introduction is followed by the key findings relevant to the theme that we were able to glean from the 28 articles. The themes are the following:

- Defining innovation and innovativeness.
- Measuring innovativeness.
- Factors influencing innovativeness.
- New product development.
- Climate/culture.
- Innovation systems.
- Innovativeness and firm performance.

## 3. Results and Discussion

Two of the 28 articles come from Canadian government employees. Otherwise, the authors are faculty and students from several different universities. The highest number of articles (five) is from 2008. Six of the articles were published in *Forest Products Journal*, while four articles each were published in *Forest Policy and Economics*, *Journal of Forest Products Business Research*, and *Canadian Journal of Forest Research*.

Table 1 outlines the articles identified during our selection process. In addition, the table shows the seven themes we identified as the key areas covered by the set of articles. As can be seen, most articles cover only one or a few of the seven themes.

### *3.1. Defining Innovation and Innovativeness*

Innovativeness is generally characterized as a function of adoption [16], creation [17] or a combination of the two. In other words, an innovative individual or firm tends to be an early adopter of new concepts, products and technologies; tends to develop or create new ideas, concepts and products; or some mix of the two. Innovativeness is a characteristic of an individual or company, while an innovation is an outcome, not a characteristic. Although the findings below will show that the terms are, at times, used interchangeably, it is important to note the difference. An innovation is something new, such as a product, service or way of doing things.

Focusing on small firms and using qualitative methods, a study focused on Oregon and Alaska finds that innovation and innovativeness are terms that tend to be used interchangeably. The responses of interviewees regarding innovation can be categorized into seven different aspects: (1) uniqueness, (2) a way of thinking, (3) marketing, (4) customer orientation, (5) process, (6) product and (7) business systems. Ultimately, the authors suggest that 1–4 can logically fit within 5–7 and, thus, suggest that the industry sees three primary forms of innovation: product, process and business systems [18]. Managers from larger companies (including some from Europe and Oceania) indicate a similar innovation typology [19]. As outlined in the next section, one view of innovation is that for an individual company, an innovation can be something created by that company or the adoption of a product, process or business system that is new to that company. Product innovation includes new-to-the-world products, as well as the more common and mundane product improvements and adaptations [18]. Process innovation is about changes or improvements to manufacturing processes [18]. This type of innovation is the traditional strength of forest sector companies, driven by high relative raw material input costs and a commodity or production mentality. Finally, business systems innovation represents a myriad of activities that a company can use in business and marketing management [18]. An example of a business systems innovation is the adoption of a new customer relationship management module in a company's enterprise resources planning software system.

Managers in the Hansen *et al.* [19] study identify a number of important attributes of innovative companies. Being innovative is synonymous with creating or adopting something new, and managers regularly refer to new products, services and technology. Creating the right culture or atmosphere conducive to innovativeness is a theme addressed in more detail later. Maintaining a close and functional link with the market is seen as vital to being an innovative company. Managers see innovators as those companies that proactively work to stay ahead of the competition. Finally, innovative companies are those that focus on the future and position themselves to adapt to a changing environment [19]. As outlined above, innovativeness is something that managers from this particular study see manifested through company actions and tendencies.

**Table 1.** Thematic focus of the referenced articles on innovation in the North American forest sector, 2000–2013.

| Referenced articles | Defining innovation and innovativeness | Measuring innovativeness | Factors influencing innovativeness | New product development | Climate/culture | Innovation systems | Performance |
|---|---|---|---|---|---|---|---|
| [20] Anderson 2006 | ■ | ■ | ■ | | | | |
| [21] Barčić, Vlosky, Motik 2011 | | ■ | ■ | | ■ | | |
| [22] Bumgardner, Bush, West 2001 | | | | ■ | | | |
| [23] Bumgardner, Bush, West 2000 | | | | ■ | | | |
| [24] Crespell, Hansen 2009 | | | | | ■ | | |
| [25] Crespell, Hansen 2008 | | | ■ | | ■ | | |
| [26] Crespell, Hansen 2008 | | | | | ■ | | ■ |
| [27] Crespell, Knowles, Hansen 2008 | | ■ | | | | | |
| [28] Crespell, Knowles, Hansen 2006 | ■ | ■ | ■ | ■ | ■ | | ■ |
| [29] Fell, Hansen Becker 2003 | | ■ | | | | | |
| [30] Fell, Hansen, Punches 2002 | | | ■ | | | | |
| [19] Hansen, Juslin, Knowles 2007 | ■ | ■ | ■ | | ■ | | |
| [31] Hansen 2006 | | ■ | | ■ | | | |
| [32] Hansen 2006 | ■ | ■ | ■ | ■ | | | |
| [18] Hovgaard, Hansen | ■ | | | ■ | ■ | | |
| [33] Knowles, Hansen, Dibrell 2008 | ■ | ■ | | | | | ■ |
| [12] Knowles, Hansen, Shook 2008 | ■ | ■ | | | | | |
| [34] Nakamura, Nelson, Vertinsky 2003 | ■ | | ■ | | | | |
| [35] Orozco, Hansen, Knowles, Leavengood 2013 | | | ■ | | | ■ | |
| [36] Schaan, Anderson 2002 | ■ | | | | | | |
| [11] Shook and Ganus 2003 | | ■ | | | | | |
| [37] Stanturf, Kellison, Broerman, Jones 2003 | | | | | | ■ | |
| [38] Stone, Benjamin, Leahy 2011a | ■ | | ■ | | | ■ | |
| [39] Stone, Benjamin, Leahy 2011b | ■ | | | | | ■ | |
| [40] Van Horne, Poulin, Frayret 2012 | | | | | | ■ | |
| [41] Van Horne, Poulin, Frayret 2006 | | | | | | ■ | |
| [42] Van Horne, Poulin, Frayret 2005 | | | | | | ■ | |
| [43] Wagner, Hansen 2005 | | | ■ | | | | |

Generally, forest industry managers do not see their operations as highly innovative [33]. However, the findings are consistent that companies are more innovative with respect to production processes than other forms of innovation [12,28,34,36]. This tendency is likely tied to the fact that raw material costs are typically a large percentage of the total costs for wood products, so it is logical to look for production efficiencies. Qualitative evidence suggests this is also true for logging contractors [38,39], and process innovations are adopted via a cost reduction motivation, similar to that of manufacturing facilities. In a category of companies entitled "support services for forestry," Anderson [20] finds the sector to show few indications of being innovative when compared to environmental consulting firms. This is especially true with respect to radical innovations.

### *3.2. Measuring Innovativeness*

Companies do not appear to be particularly active in attempting to measure their own innovativeness [19], which could, for example, allow them to benchmark against other companies or among units in their own organization or to track progress in efforts to enhance innovativeness. However, there has been considerable effort invested in developing measures of innovativeness by academicians. There are basically two methods employed: (1) that outlined by Rogers [16], where the more innovations a firm has adopted, the more innovative it is considered; and (2) a self-report evaluation based on multiple items either directly describing innovativeness or referring to the propensity of a firm to create and/or adopt innovations. These self-reports are generally based on the three basic types of innovation outlined earlier: product, process and business systems [12,21,28,31,32]. It is important to note that governmental studies of innovation typically follow the measurement guidelines outlined in the Oslo Manual, and one article included here follows that method [20].

Work following the Rogers paradigm has often focused on the residential construction industry. Homebuilders that are early to adopt one engineered wood product are also likely to be an early adopter of other engineered wood products. Using a composite measure of innovativeness (time and extent of adoption) can allow marketers to more efficiently target a specific market (*i.e.*, early adopters) [29]. Shook and Ganus [11] use a single-item scale that is only indirectly related to time of adoption to measure innovativeness in the Western U.S. residential construction industry. The item ranges from 1, your company is not familiar with (the product), to 7, your company routinely uses (the product).

The time and extent of adoption has been shown to face several issues making its practical use difficult. For example, current technology (manufacturing technology used by a sawmill) is not a strong measure of innovativeness. Partially, this is because different respondents from the same mill provide different information even for concrete issues, such as the type of machine centers in their mill [12]. Respondent memory can introduce significant error into the measure. Furthermore, the time of adoption and the degree of adoption measure different constructs [29]. Another challenge with this method is identifying products that are sufficiently new to separate the more from less innovative. For example, using six engineered wood products, Shook and Ganus [11] find that the lowest level of routine use was 59% of respondents who use finger jointed studs. With this level of routine

use, the six selected products may not be sufficiently new to differentiate among firms based on their innovativeness.

One scale development effort in the forest sector literature is an innovativeness scale developed around six dimensions, the propensity to create products, processes and business systems and the propensity to adopt products, processes and business systems. The scale was developed via two separate data collection efforts [12,33] and further validated with data from another study [27]. The scale consists of 15 items and has seen use in several different countries [44]. This scale is what has been used in six of 28 articles included here and is the primary means for testing innovativeness to performance relationships. Barčić *et al.* [21] follow a similar dimensional approach to measurement, but employ a different set of items.

### *3.3. Factors Influencing Innovativeness*

There are many factors that can influence the innovativeness of a company. There has been extensive work done in the general literature investigating these factors or characteristics. For example, Damanpour [4] provides a synthesis of findings and catalogs a total of 13 characteristics and their generally accepted impacts on innovativeness. The forest sector literature is not as comprehensive in its coverage of factors.

Firm size can potentially play a positive or negative role in firm innovativeness, depending on the specifics of the situation. Larger sawmills tend to be more process innovative [28], and generally, large firms focus more on process innovation, while smaller firms focus on product and business systems innovation, where they can excel even with limited resources [43]. Large homebuilders tend to be more innovative (based on the number of adopted products) than small homebuilders [30]. The recommendation for smaller companies is to carefully recognize the level of process innovation to be competitive and invest remaining resources in other areas of innovation [43]. Focusing on furniture companies, Barčić *et al.* [21] find a positive connection between company size and process and business systems innovation, but not product innovation.

In a case study of a small, secondary company in Oregon, fear of change, ineffective management and poor communication are challenges to being innovative [25]. In Maine, the primary limiting factor for logging contractors is financing [38]. The lack of cooperation from other actors in the innovation system (specific focus on biomass utilization) also creates a formidable barrier to innovation [38]. As would be expected, the price of biomass and the cost of the particular innovation (e.g., the price of a piece of equipment) are key influencers that impact adoption decisions [38]. Financial limitations are also seen as the most significant limitation to innovation by Oregon companies, followed by the poor state of the economy. Also identified are a lack of time, a lack of manpower and interference from government [35].

Generally, North American companies operate so lean that staff are unable to spend time focusing on innovation [34]. These companies lack the "organizational slack" to think about and implement new ideas [19]. Perhaps partially as a result, these companies tend to lack programs for systematically capturing and inventorying innovative ideas or even general approaches for facilitating innovativeness [19]. While organizational slack is tied to profitability and financial resources, the bare-bones, lean style of operations is also steeped in culture, so there may be options for increasing

organizational slack without major monetary investments. In other words, managers can proactively alter the culture in a way that increases slack by, for example, providing some "free" time for creative or innovation-focused thinking.

Companies in Canada are heavily reliant on suppliers as a source of information for innovation [20]. In fact, the situation is described as follows, "The reliance on suppliers, particularly machinery, equipment and instrument suppliers, would appear to be a plausible explanation for the lack of innovation in this industry." Over-reliance on suppliers is problematic, since new equipment, control system and software from suppliers are readily available to all players within an industry [34]. This is consistent with North American firms that identify equipment suppliers as important sources of innovative ideas [32,34].

### *3.4. New Product Development*

New product development (NPD) processes and success factors have received extensive attention in the general literature. Extensive benchmarking studies have been conducted outlining cutting edge practices implemented across industry sectors [45]. However, there is limited forest sector literature covering this important area.

The highly structured and managed new product development practiced in large consumer goods firms is not the norm in most of the forest sector. Generally, firms focus on idea generation and feasibility and financial analysis, largely ignoring customer/market focused activities [28,32]. Six basic NPD steps are practiced by small firms in Oregon and Alaska: (1) idea generation, (2) screening, (3) design, (4) prototyping/samples, (5) testing, and (6) customer and employee input [18]. A possible exception to the lack of a systematic approach is in large furniture companies that appear to implement structured NPD processes that are iterative and involve an interaction between marketing and manufacturing [23]. A comparison between plywood and oriented strand board (OSB), representing old and new generation panels, finds that OSB mills are more product-innovative and use a more structured approach to NPD than plywood mills, despite the theory that suggests otherwise [46]. The difference from theory may be that plywood mills are more often smaller and privately owned, while OSB mills are more often larger and corporate owned [31]. Overall, more innovative companies tend to create more new products, are more likely to use new product development tools and have a more structured NPD process [28]. Given these findings, further use of NPD tools and more structured NPD processes are clear opportunities for improved innovation performance in the industry [32]. While design professionals likely play no role in NPD for structural wood products, their role within large furniture companies is variable, with some companies giving designers broad freedom in selecting product features [22].

### *3.5. Organizational Climate/Culture for Innovation*

An organizational culture is often described as, "the common set of values, beliefs and norms that help make sense of an organization [47]." On the other hand, climate is an organizational reality [48] and is seen as the perception of the culture. In this way, it is a lower-level issue than culture. Culture is normative and stable in comparison to climate, which is more descriptive and changeable. Therefore, climate is how culture is expressed at a given time [26].

Hansen *et al.* [19] emphasize that most of the insights of their work have a close connection to company culture and that maintenance of an appropriate culture can minimize challenges to being innovative. Innovativeness of individual employees is an ingredient that allows the development of product, process and business systems innovations [18]. Together, the total can be more than the sum of the parts, since synergies among innovative employees can be realized. In the general literature, market orientation is described as a company culture [49], and a strong, positive relationship is shown with innovativeness [50]. There are indications that forest sector companies recognize the positive relationship between market orientation and innovativeness [19], which has been shown in earlier literature [28].

A consistent and positive relationship between the climate for innovation and innovativeness, mediated by organizational commitment, is shown in a series of studies [24–26]. The climate for innovation was measured using team cohesion, supervisor encouragement, autonomy, challenge, openness to innovation and resources. A workforce that fosters innovation results in a more committed workforce. Innovation results from creating an environment that encourages risk taking and experimentation. Therefore, investments in the organizational climate may positively affect both innovativeness and performance, without the major capital investment often associated with radical innovation [26]. The mentioned studies have all been conducted in the U.S. However, Nybakk *et al.* [51] compared the U.S. wood industry with Norway and found that the innovation climate for innovation's effect on firm performance was consistent, regardless of the country of operation, industry sector, size or country. The similarities in these results could be connected to the fact that the countries have a similar Western culture and wealth status. Results could differ in non-Western countries or post-communist countries transitioning to a market-based economy [51].

### *3.6. Innovation Systems*

An innovation system is often considered the ecosystem within which a firm operates. Reference to an ecosystem suggests a host of factors that influence innovation in a firm, for example, competitors, government policies and research centers [52]. As mentioned previously, research in this paradigm has been common in Europe, but has only recently been embraced in the North American forest sector [35].

In Oregon, forest sector firms have low awareness of programs (mostly governmental) that are available to them that could facilitate innovation. In this setting, the innovation system is not functioning as well as desired. Given that these firms identify financing as a hurdle to innovation and some of these programs are specifically designed for financing, awareness is a major gap in the system [35]. In Maine, logging firms hold a unique position in the innovation system, where they are able to influence the development of innovation through their communication with both landowners and mills [38]. Landowners play a particularly important role in the logging innovation system in Maine, since they can provide test sites for contractors to experiment with new ideas and/or equipment [39]. A critical action that landowners can take to influence innovation by contractors is offering long-term contracts. Education and public research is the area that least influences the innovation system in Maine [38]. In contrast, in the Southern U.S., industry/university research cooperatives are credited as the most effective means for accomplishing innovation [37].

R&D centers are important actors in the innovation system. Van Horne *et al.* [41] use Canadian centers of expertise to create an innovation value matrix with the purpose of analyzing how the perceived value of innovation and knowledge is connected to the innovation process. They also suggest that centers must develop tools that allow their findings (knowledge) to be efficiently disseminated and implemented in the industry [42]. The same authors also investigate the outcomes of university-industry research centers, finding benefits for multiple actors in the innovation system [40]. Finally, the government in Canada is shown to have a significant role in research and development [34].

### *3.7. Innovation/Innovativeness and Performance*

Ultimately, managers and academicians are interested in innovation because it is expected to positively impact financial performance. A strong connection between innovativeness and financial performance exists in the literature [8,50,53,54]. With respect to sawmills, there is a strong correlation between innovativeness and sales growth and gross profit, with the strongest relationship being between process innovativeness and firm performance [33]. Using a separate sample of sawmills, a strong relationship is shown between a composite measure of firm performance and innovativeness [28]. Some evidence suggests that secondary manufacturers are better positioned to convert innovativeness into enhanced performance [26].

## 4. Conclusions

### *4.1. For Researchers*

The forest sector has had a low growth rate compared with other industries, and many products in the sector are in the mature phase of their life-cycle. Forest sector companies are typically seen as conservative and isolated, with limited knowledge transfer, and they tend to inadequately utilize market opportunities and possess a weak focus on innovation. Simultaneously, forest business researchers have shown the importance of innovativeness, linking innovativeness to firm performance within the forest sector. As researchers investigate other antecedents to firm performance, the inclusion of innovativeness is necessary, along with other constructs, such as market orientation, learning orientation and entrepreneurial orientation.

It appears that the definitions of innovation and innovativeness are readily accepted in the literature, and existing measures do an adequate job of capturing the two constructs. However, despite this and the growing body of knowledge, there remain many gaps in the literature that deserve attention. There is considerable fine tuning necessary to more fully understand the innovativeness-performance relationship. While there are findings that show a positive link, there is insufficient coverage of the various sectors of the industry. A better understanding is needed of the types of innovativeness and their relative impacts on performance.

Existing research does little to illustrate the factors that moderate the innovativeness-performance relationship. Limited work has been done specific to company size and country of operation, but a myriad of potential moderators remain to be investigated. Examples include marketplace

dynamism/hostility, the nature of the executive team and recessionary periods, such as the Great Recession, but the list of relevant factors is much longer.

The identification of key differences between innovative and non-innovative companies is needed. What are the key antecedents to innovativeness in forest sector firms, and how do these differ among cultures, regions, sectors, *etc.*? This research stream should stay focused on firm-internal factors related to the executive team, the culture and climate created by that team and the resources possessed by the firm. As mentioned above, forest sector firms typically lack the slack resources, such as personnel time, that are needed for effective innovation. Does this translate to slack resources being the deciding factor between successful and unsuccessful innovators? On the other hand, is it firms that are successful that have the resources to dedicate to innovation? Which comes first, the innovation or the success?

As mentioned above, much of the European research has been done within the innovation systems paradigm. More work is needed in this area within the context of the North American setting. It is often said that North American forest sector companies fail to be sufficiently innovative, yet we have a limited understanding of the key causes that may be external to the firms themselves and, instead, be a factor of the system within which the companies operate. This context, of course, differs not only country-to-country, but may differ systematically, even among U.S. states or Canadian provinces. One especially relevant aspect of the innovation system is the apparently critical role played by equipment and technology suppliers.

Although the evidence suggests that little structured product development happens in the sector, there are clearly significant product modifications and incremental improvements taking place. Little is known about the evolution of these efforts within the sector. Are companies becoming more systematic over time in managing product development efforts? There is some evidence of increasing marketing sophistication within the sector that includes closer relationships with customer and other end users. This should translate to enhanced product offerings that better meet market needs. An important development would be an understanding of how increased interaction among players in the market impacts efforts within a company to better manage the product development process.

The field of innovation is evolving quickly, and the forest sector innovation literature is devoid of studies addressing topics, such as open innovation, user-driven innovation, green/sustainable innovation, crowd funding, *etc.* Living labs, such as the EU-financed, ENERGYViLLab [55], designed to increase, "best practice in the use of energy from renewable sources, energy saving and sustainable mobility", are an attempt to facilitate innovation within a specific geography. Documentation of the successes and failures of such efforts are needed to better inform further developments in the innovation infrastructure.

### *4.2. For Industry Managers*

There is a management adage that, "you can't manage what you don't measure." The literature suggests that forest sector companies are not highly proactive in measuring and monitoring innovativeness. However, there is an apparent consensus that being more innovative is desirable for its positive impacts on financial performance. This suggests a significant opportunity for improvement by becoming more systematic in the approach to innovation. Establishing metrics appropriate for a given

organization and monitoring performance in meeting those metrics is an essential ingredient for continuous improvement in this area. Companies would be well-advised to make the pursuit of innovation a greater part of their daily activities.

A positive culture and climate within a company have a clear connection to improved innovativeness and firm performance. Generally, findings describing the culture of the industry, including the sectors of the industry consuming wood products, such as housing, paint a picture of a conservative group that fails to sufficiently invest in innovativeness and innovation. Culture change presents a significant opportunity within the industry to strive toward the improved development of new products, processes and business systems to reap the rewards of improved performance. Any effort to shift company culture must start with commitment and actions from top managers.

The same systematic approach is needed with respect to NPD. The literature describes an industry that lacks proactive and systematic product development efforts. Here, we encourage managers to embrace a total product mentality and move beyond a commodity-focused approach. A total product is made up of a host of attributes, including associated services, that are desired by the customer. Customers need a product that solves a problem for them. Using this way of thinking opens up many avenues for positive product development.

Firm size and associated resource availability influence a firm's approach to innovation. Accordingly, managers should carefully evaluate their available resources and invest accordingly. For example, as the findings above suggest, most small firms should not attempt to be on the cutting edge of automation and process technology. Instead, focusing on unique products and strong customer relationships is likely a better investment.

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## Author Contributions

All authors contributed to the conceptual development and methodology for the paper. Eric Hansen led general development of the text with assistance from Erlend Nybakk and Rajat Panwar.

## Conflicts of Interest

The authors declare no conflict of interest.

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