

# Educational Needs of the Forest Products Industry in Minnesota and Virginia in 2012

Omar Espinoza

Robert Smith

Scott Lyon

Henry Quesada-Pineda

Brian H. Bond

---

## Abstract

The forest products industry has been greatly impacted by the Great Recession, with many firms reducing output or closing operations to remain competitive. Educational training has also been a casualty of cost reduction efforts by firms. Yet, we know that a well-trained workforce is better prepared to compete, is more innovative, and is a long-term competitive advantage for companies. This research looked at current educational needs in Minnesota and Virginia by conducting an electronic survey and personal interviews with management personnel in the forest products industry. A key finding was that the factors that have impacted firms since the start of the recession (2008) were similar between states and included the housing market, transportation costs, energy costs, and changing customer demand. Results by size of firm and type of firm varied significantly, and training needs differed by state and size and type of firm. The identified training needs included quality/process control, process improvement, marketing, sales, motivating personnel, and total quality management. Firms rated personal visits and short courses as the primary methods of providing training. During the in-person interviews, managers were asked about the reasons for their companies' success during the recession. In Virginia, they felt that being customer focused, flexible, and diversified and having good financial management were the key issues. In Minnesota, they believed having high-quality products and good customer relationships, being "lean," controlling costs, and being flexible were their success factors.

---

The US forest products industry has been facing significant challenges over the last two decades. Domestic production has lost market share to low-cost producers overseas. This has been especially felt in certain sectors, such as household furniture and flooring (Schuler and Buehlmann 2003, Quesada and Gazo 2006, Buehlmann and Schuler 2009). The economic downturn and particularly the decline in the housing market have negatively affected domestic demand and resulted in thousands of layoffs and plant closures (Anonymous 2007; Buehlmann et al. 2007, 2008). Some authors estimate the job losses in the forest products sector to be in the hundreds of thousands (Woodall et al. 2011). Also, substitute materials are taking market share from wood-based products.

One method to develop a competitive advantage during challenging times is to invest in equipment and/or people. Investment in technology and equipment can result in immediate savings in production costs through increased output, better yields, and less waste. An investment in training for employees is often a more difficult decision. Yet, most companies will acknowledge that their people are their most valuable resource. It is more difficult to measure the internal rate of return or the payback period of educational training for employees. During difficult times,

investments in education and training are often the first things to be eliminated. However, we know that an educated workforce is more productive and innovative (Watson et al. 2009). For firms to remain competitive in our changing marketplace, they must invest in their employees as well as their equipment (Aragón-Sánchez et al. 2003).

Organizations supporting the industry with training efforts must understand companies' needs and deliver programs that have the greatest impact. Numerous studies over the past decades have identified educational needs of the industry (Thomas et al. 1986, Bratkovich and Miller 1993, Hansen and Smith 1997, Smith et al. 1998, Bowe et

---

The authors are, respectively, Assistant Professor, Dept. of Bioproducts and Biosystems Engineering, Univ. of Minnesota, Saint Paul (espinoza@umn.edu [corresponding author]); and Associate Dean and Professor, College of Natural Resources and Environment (rsmith4@vt.edu) and Research Associate, Assistant Professor, and Associate Professor, Dept. of Sustainable Biomaterials (lyon115@googlemail.com, quesada@vt.edu, bbond@vt.edu), Virginia Polytechnic Inst. and State Univ., Blacksburg. This paper was received for publication in September 2012. Article no. 12-00106.

©Forest Products Society 2012.

Forest Prod. J. 62(7/8):613–622.

al. 1999). These studies indicated marketing, business management, and process/manufacturing issues as being priorities. Over the years, educational courses have been developed and offered by numerous universities and private firms to meet the needs identified by these findings. However, we do not know how the Great Recession has changed the educational needs of the forest products industry and whether firms in the industry want to receive training in alternative formats. This research was conducted to identify current educational needs in two states (Minnesota and Virginia) and to determine if these needs vary by region and type of organization (i.e., primary and secondary manufacturers) and how deliverers of such training can best meet the industry needs.

### Objectives

The research effort described here had the following objectives: (1) identify the educational needs of the forest products industry in Minnesota and Virginia, (2) compare the needs between states and by company size and type of industry, and (3) identify the most effective methods to deliver training to the industry.

### Materials and Methods

During May to July of 2012, an online survey was conducted concurrently in Minnesota and Virginia to assess the educational needs of the forest products industry. Following the survey, 19 companies (10 in Minnesota, 9 in Virginia) were interviewed in person to verify and expand on the results from the survey. Dillman's Tailored Design Method for Web survey was used (Wright 2005, Dillman et al. 2008). The use of the Internet to conduct surveys has grown considerably during the last decade. Web surveys are less costly, their results are easier to process because they are in electronic format, they can reach a potentially wider sample and specific populations, and they may yield better response rates because of the increasing level of comfort people feel with electronic communication (Kaplowitz et al. 2004). Some concerns in using Web surveys are the difficulty of obtaining current e-mail addresses, the potential self-selection bias (people more likely to respond to an online survey), and bias imposed by lack of sampling of respondents that do not own an e-mail account or have access to the Internet. However, research has found that Web surveys obtain response rates comparable to, or even better than, mail-based surveys (Kaplowitz et al. 2004, Wright 2005).

### Questionnaire

Based upon previous work of the researchers, a 15-item questionnaire was developed as follows: a first draft was evaluated by industry personnel and faculty from academia, and then a revised version was tested by six industry representatives from each of the two target states. In both evaluations, participants were asked to provide feedback about relevance of questions, clarity, and potential errors. The final version contained the following sections: demographic information (primary business area, number of employees, number of physical locations, and type of product distribution), business management factors (major factors for business, strategic plan, the major performance measures used, and product development), training needs (business factors, greatest training need, training delivery

method, and current training providers), and other comments.

### Target population and e-mail list

The target population for this study were forest products companies in Minnesota and Virginia (North American Industry Classification System codes 321 Wood product manufacturing, 322 Paper manufacturing, 33711 Wood kitchen cabinet and countertop manufacturing, 337122 Non-upholstered wood household furniture manufacturing, 337211 Wood office furniture manufacturing, 337212 Custom architectural woodwork and millwork manufacturing, 423310 Lumber merchant wholesalers, 423990 Timber and timber products merchant wholesalers, 423990 Forest products merchant wholesalers, 444190 Lumber retailing yards, 493190 Lumber storage terminals). An e-mail list was compiled using both a commercial business directory and each state's Department of Natural Resources databases. A random list of 450 businesses in each state was selected, e-mail addresses were obtained by searching the companies' Web pages and trade association members' list, and personal telephone calls were made to companies for verification. A final e-mail list of 292 businesses in Minnesota and 396 in Virginia was used to send companies an invitation to participate in the survey.

### Data collection

The Web survey was conducted between May and July of 2012. Two reminder messages were sent 1 and 2 weeks after the first communication. In total, 73 responses were received in Minnesota and 101 in Virginia. After subtracting undeliverable e-mail addresses, response rates were 36.0 and 32.7 percent in Minnesota and Virginia, respectively.

### Data analysis

Data analysis methods used included descriptive statistics (average and standard deviation), ranking, comparison of means (*t* test and ANOVA at  $\alpha = 0.05$ ), and comparison of proportions (Pearson's chi-square tests). Interpretation was aided using tables and charts. Responses were downloaded to an Excel spreadsheet and statistical tests were run using SPSS statistical software.

### Assessment of potential nonresponse bias

Nonresponse bias was assessed by comparing early and late respondents. This practice assumes that there is a continuum from early respondents to late respondents, and that late respondents can be used as a proxy of nonrespondents (Dalecki et al. 1993, Etter and Perneger 1997, Lahaut et al. 2003). Responses were grouped in two "waves," and two demographic attributes were compared: business type (primary manufacturing, secondary manufacturing, and distributors) and company size (small, and medium/large). No significant differences ( $\alpha = 0.05$ ) were found between early and late respondents for either attribute for participants in Minnesota (Pearson chi-square test,  $P = 0.328$  for business type and  $P = 0.243$  for company size) and Virginia (Pearson chi-square test,  $P = 0.539$  for business type and  $P = 0.556$  for company size).

### Study limitations

As with all surveys, limitations apply to the results obtained from this study (Alreck and Settle 2004). Most

likely, results were obtained from a single person within each responding company. These respondents' answers may not have necessarily reflected the perspectives of other decision makers within the company. The method used, online survey, may have discouraged some companies from participating, including those that are not Internet savvy or simply do not feel comfortable answering a survey online. Another limitation comes from the small sample size compared with the population.

### Company interviews

In order to further explore educational needs of the industry, personal interviews were conducted using an open-ended questionnaire. The interviews were conducted to obtain in-depth information that may be difficult to obtain with an impersonal randomized online survey. Representatives of 10 companies in Minnesota and 9 in Virginia were interviewed in person. A convenience sample of companies included sawmills, truss manufacturers, wood-treating facilities, distributors/wholesalers, and millwork and cabinet shops, and their sizes ranged from very small (3 employees) to large (over 200 employees) companies.

## Results and Discussion

### Demographics

Participants were asked to choose from 17 industry subsectors to identify their primary classification. Similarly, companies were asked about the number of employees. To facilitate the analysis, companies were grouped into three categories of business type (primary manufacturer, secondary manufacturer, and distributors) and two categories of size (small companies with 25 or fewer employees and medium/large companies with more than 25 employees). Table 1 summarizes the demographic information of participants. More primary manufacturers responded from Virginia, while more secondary manufacturers responded from Minnesota, which is consistent with information found in previous reports about the relative proportion of primary and secondary industries in the larger populations of these two states (Rephann 2008, Skurla et al. 2010). Company size was similar between the states.

Companies were asked if they owned more than one facility. In Minnesota, 63 percent of respondents reported being a one-facility operation. This proportion in Virginia was higher with 77 percent reporting having one facility. Answers about product distribution were similar in the two states (Table 2, Pearson chi-square test,  $P = 0.806$ ).

### Business factors

Respondents were asked to rate a list of external business factors according to their effect on their businesses, on a scale from 1 to 5, where 1 = very little or no impact on our business, 3 = average impact, and 5 = greatly impacted our business. The top five items were similar for the two states and included the housing market, transportation costs, energy costs, changing customer demand, and business closures (Table 3). Companies in Virginia rated raw material costs and transportation costs significantly higher than did companies in Minnesota (indicated by double asterisks in Table 3), probably due to the relatively larger percentage of primary manufacturing companies in the Virginia sample. Although not statistically significant, lack of skilled labor seems to be more of a concern for companies in Virginia than in Minnesota (ranked 9th in Virginia compared with 11th in Minnesota), and business closures received a higher rating of importance in Minnesota than in Virginia (ranked 5th in Minnesota compared with 8th in Virginia). Surprisingly, globalization, e-commerce, and international competition were some of the lowest rated items in both states.

Statistical tests were performed to investigate the effect of business type and company size on perceptions about business factors. Perceptions about external business factors were not significantly different among companies of different types (primary, secondary, and distributor; Table 3) in Minnesota (according to a *t* test). However, company size did have a significant effect on responses in both Minnesota and Virginia (indicated by single asterisks in Table 3). Virginia primary manufacturers rated the following business factors significantly higher than secondary manufacturers and distributors (ANOVA, indicated by triple asterisks in Table 3): globalization (3.36 vs. 2.47 and 2.60, respectively), government regulations (3.96 vs. 3.14 and 2.56), energy costs (4.38 vs. 3.68 and 3.89), and housing market (4.31 vs. 3.71 and 3.00).

Companies were also asked to indicate the last time they reviewed their strategic plans. There were no statistical differences between the responses in the two states (Table 4). A majority of respondents (78% and 67% of companies in Minnesota and Virginia, respectively) reported having reviewed their strategic plans within the last year.

Participants were asked to list the most commonly used business performance measurements. Responses were very similar between the states (Table 5). Monthly sales and profit figures, hourly production, customer satisfaction, and production per employee were the most used performance

Table 1.—Participants' type of business and size.<sup>a</sup>

Category	Minnesota companies		Virginia companies	
	No.	%	No.	%
Company type				
Primary manufacturer	18	24.7	31	30.7
Secondary manufacturer	50	68.5	49	48.5
Distributor	5	6.8	12	11.9
Company size				
Small companies (≤25 employees)	40	54.8	47	46.5
Medium/large companies (>25 employees)	33	45.2	51	50.5

<sup>a</sup> Percentage calculated based on 73 responses in Minnesota and 101 in Virginia. Only 92 companies in Virginia reported type of business and 97 reported number of employees. No significant differences in business type or size were found between locations (Pearson chi-square test).

Table 2.—Product distribution.<sup>a</sup>

Category	Minnesota companies		Virginia companies	
	No.	%	No.	%
We sell primarily in the state we manufacture	22	30.1	27	26.7
We sell regionally	25	34.2	30	29.7
We sell nationally	21	28.8	19	18.8
We sell internationally	15	20.5	21	20.8

<sup>a</sup> Multiple responses were possible. No significant differences were found between the two states in number of companies in each category (Pearson chi-square at 0.05,  $P = 0.806$ ).

indicators among respondents. Investment in training, environmental impact, and percentage of sales spent on research and development (R&D) were the least used metrics. The others category included all operating expenses, Web presence, marketing and advertisement, quote-to-order ratio, and monthly departmental budgets to actual.

Companies were asked whether they had an R&D program. Twenty-nine percent of respondents in Minnesota and 13 percent in Virginia reported having an R&D program. Medium/large companies were significantly more likely to have an R&D program than small companies (Pearson chi-square at 0.05) in both Minnesota and Virginia (86% and 69% of all companies reporting having an R&D

Table 3.—Participants' average ratings of business factors that most impacted businesses since 2008 by company size and business type.<sup>a</sup>

Business factor	Company size <sup>b</sup>					
	Minnesota			Virginia		
	Overall	Small	Medium/ large	Overall	Small	Medium/ large
Housing market	3.90 (1)	3.92 (1)	3.88 (3)	3.84 (3)	3.54 (3)*	4.26 (2)*
Transportation costs**	3.79 (2)	3.51 (2)*	4.13 (1)*	4.28 (1)	4.08 (1)*	4.57 (1)*
Energy costs	3.63 (3)	3.46 (4)	3.84 (4)	3.95 (2)	3.78 (2)	4.20 (3)
Changing customer demand	3.58 (4)	3.51 (2)	3.66 (6)	3.56 (5)	3.45 (5)	3.71 (5)
Business closures	3.49 (5)	3.21 (5)*	3.97 (2)*	3.21 (8)	2.88 (8)*	3.70 (7)*
Raw material costs**	3.37 (6)	3.13 (6)*	3.75 (5)*	3.73 (4)	3.51 (4)*	4.06 (4)*
Labor costs	3.21 (7)	3.08 (8)	3.38 (7)	3.47 (6)	3.38 (6)	3.60 (8)
Government regulations	3.14 (8)	3.10 (7)	3.19 (8)	3.36 (7)	3.10 (7)*	3.71 (5)*
Green business practices	2.79 (9)	2.59 (9)*	3.19 (8)*	2.77 (11)	2.56 (11)	3.06 (10)
Interest rates	2.68 (10)	2.59 (10)	2.87 (11)	2.53 (12)	2.26 (14)*	2.91 (11)*
Lack of skilled labor	2.62 (11)	2.36 (12)	2.94 (10)	2.93 (9)	2.71 (10)	3.23 (9)
Globalization	2.52 (12)	2.33 (13)	2.75 (12)	2.77 (10)	2.76 (9)	2.80 (12)
E-commerce	2.45 (13)	2.41 (11)	2.50 (14)	2.41 (14)	2.42 (13)	2.39 (14)
International competition	2.24 (14)	1.95 (14)*	2.59 (13)*	2.51 (13)	2.44 (12)	2.60 (13)

  

Business factor	Business type <sup>c</sup>					
	Minnesota			Virginia		
	Primary	Secondary	Distributor	Primary	Secondary	Distributor
Energy costs	4.06 (1)	3.49 (4)	3.50 (4)	4.38 (2)***	3.68 (3)***	3.89 (2)***
Housing market	4.06 (1)	3.81 (1)	4.25 (1)	4.31 (3)***	3.71 (2)***	3.00 (5)***
Transportation costs	4.00 (3)	3.69 (2)	4.00 (2)	4.56 (1)	4.18 (1)	4.11 (1)
Business closures	3.83 (4)	3.40 (5)	4.00 (2)	3.65 (6)	3.08 (8)	2.56 (9)
Raw material costs	3.78 (5)	3.27 (6)	3.50 (4)	3.92 (5)	3.62 (4)	3.56 (4)
Changing customer demand	3.50 (6)	3.63 (3)	3.25 (7)	3.60 (7)	3.58 (5)	2.89 (6)
Labor costs	3.17 (7)	3.22 (7)	3.25 (7)	3.48 (8)	3.40 (6)	3.75 (3)
Government regulations	3.11 (8)	3.12 (8)	3.50 (4)	3.96 (4)***	3.14 (7)***	2.56 (9)***
Green business practices	3.00 (9)	2.85 (9)	2.50 (10)	3.04 (11)	2.56 (10)	2.67 (7)
Interest rates	2.94 (10)	2.58 (11)	3.25 (7)	2.84 (13)	2.50 (12)	1.89 (14)
Globalization	2.56 (11)	2.55 (12)	2.00 (12)	3.36 (9)***	2.47 (13)***	2.60 (8)***
E-commerce	2.56 (11)	2.41 (13)	2.50 (10)	2.13 (14)	2.55 (11)	2.44 (11)
International competition	2.39 (13)	2.20 (14)	2.00 (12)	2.92 (12)	2.20 (14)	2.30 (12)
Lack of skilled labor	2.39 (13)	2.76 (10)	2.00 (12)	3.12 (10)	2.91 (9)	2.25 (13)

<sup>a</sup> Bold items ranked among top five. Ranks ranged from 1 (very little or no impact) to 5 (greatly impacted our business). The ranking of each item is shown in parentheses.

<sup>b</sup> \* Denotes significant differences between small and medium/large companies in each state ( $t$  test). \*\* Denotes significant differences in impact of business factors between the two states ( $t$  test).

<sup>c</sup> There were no significant differences between responses of companies in Minnesota by business type. \*\*\* Denotes significant differences between businesses of different types in Virginia (ANOVA).

Table 4.—Last time companies reviewed strategic plan.<sup>a</sup>

Distribution	Minnesota companies		Virginia companies	
	No.	%	No.	%
Within the last 6 mo	40	54.8	40	39.6
Within the last year	17	23.3	27	26.7
Within the last 3 y	4	5.5	8	7.9
Within the last 5 y	2	2.7	0	0.0
Our company doesn't have a strategic plan	8	11.0	14	13.9

<sup>a</sup> Percentage calculated based on 73 responses in Minnesota and 101 in Virginia. No significant differences were found between the two states ( $\alpha = 0.05$ , Pearson chi-square  $P = 0.26$ ).

program were medium/large companies in Minnesota and Virginia, respectively). Companies with an R&D program indicated having 1 to 20 employees working in such a program, with an average of 4.5 in Minnesota and 1.3 in Virginia.

### Training needs

The importance of 31 training categories was rated by participants on a 5-point scale, where 1 = not a training need, 2 = some training need, 3 = average training need, 4 = moderate training need, and 5 = very important need for our company. Training in quality and process control, process improvement, and plant maintenance were rated relatively high in the importance scale in both Minnesota and Virginia (all of these training topics were among the five with highest ratings; Table 6), whereas environmental certification, international marketing, wood drying issues, and Six Sigma were among the lowest-rated training needs in both states (their ratings ranked at the bottom of the importance scale; Table 6). Sales abilities and marketing were ranked in the top five training needs in Virginia, but not in Minnesota, while motivating personnel and total quality management were rated among the top five in Minnesota and not in Virginia. A similar study conducted in 1996 among forest product companies in Oregon, Minnesota, and Virginia (Bowe et al. 1999) found that the industry's top five educational needs were safety regulations, product pricing, quality and process control, basic problem solving skills, and sales abilities.

There were several significant differences ( $t$  test at 0.05) in the ratings given to training needs reported by

respondents in Minnesota and Virginia (indicated by asterisks in Table 6). In all these cases, companies in Minnesota rated training needs higher than companies in Virginia: motivating personnel (3.18 vs. 2.63, respectively), total quality management (3.15 vs. 2.70), lean manufacturing (3.12 vs. 2.40), basic problem solving skills (3.02 vs. 2.67), product development (2.78 vs. 2.32), and Six Sigma (2.29 vs. 1.83). Again, this may be explained by the higher percentage of secondary manufacturers in the Minnesota sample. Specifically, in Minnesota lean manufacturing rated 7th among manufacturers, while in Virginia it rated 22nd in importance. In Minnesota sales abilities training was rated 10th, while in Virginia it was rated 2nd.

There was no significant difference between the responses of primary manufacturers, secondary manufacturers, and distributors on the importance of training needs of companies in Minnesota and Virginia. However, business size had a significant effect on how companies rated the importance of many of the training needs, as shown in Table 7. In all of these cases, medium and large companies rated needs higher than small companies, suggesting that small companies may not see a big need for training in general. The largest differences in Minnesota occurred in Six Sigma, for which medium/large companies' responses averaged 2.96 (meaning an average need), compared with 1.83 for small companies (between "not a training need" and "some training need"); energy management (3.03 and 2.13, respectively); and production management (3.59 and 2.76, respectively). In Virginia the largest differences between medium/large and small companies happened in plant maintenance (3.44 and 2.33, respectively), process improve-

Table 5.—Major business performance measures used by responding companies.<sup>a</sup>

Performance measure	Minnesota companies		Virginia companies	
	No.	Rank	No.	Rank
Monthly sales figures	62	1	75	1
Monthly profit figures	56	2	63	2
Production per hour	53	3	59	3
Customer satisfaction	49	4	54	4
Production per employee	30	5	30	5
Lost time accidents	27	6	30	5
New product development	22	7	23	7
Sales per employee	18	8	14	9
Market share increase	16	9	21	8
Investment in training	11	10	10	11
Environmental impact	11	10	13	10
Percentage of sales spent on research and development	10	12	5	12
Other (please specify)	4		1	

<sup>a</sup> Multiple responses were possible.

Table 6.—Importance rating of training needs for respondent companies.<sup>a</sup>

Training need	Minnesota		Virginia	
	Mean	Rank	Mean	Rank
Quality and process control	3.36	<b>1</b>	3.13	<b>1</b>
Process improvement	3.32	<b>2</b>	2.92	<b>3</b>
Plant maintenance	3.18	<b>3</b>	2.83	<b>5</b>
Motivating personnel*	3.18	<b>3</b>	2.63	17
Total quality management*	3.15	<b>5</b>	2.70	13
Production management	3.12	6	2.77	9
Lean manufacturing*	3.12	7	2.40	22
Product costing	3.10	8	2.78	8
General problem solving	3.09	9	2.71	11
Sales abilities	3.04	10	3.05	<b>2</b>
Marketing	3.04	10	2.89	<b>4</b>
Basic problem solving skills*	3.02	12	2.67	15
Leadership	2.98	13	2.70	12
Strategic management	2.86	14	2.63	16
Inventory control	2.85	15	2.73	10
Business planning	2.84	16	2.81	7
Product development*	2.78	17	2.32	24
Product promotion	2.75	18	2.69	14
Product distribution	2.75	18	2.43	21
Plant financial issues	2.73	20	2.51	20
Finding market information	2.71	21	2.82	6
Public relations	2.69	22	2.57	18
Branding	2.64	23	2.31	25
Energy management	2.52	24	2.53	19
E-commerce	2.36	25	2.26	27
Cleaner production technologies	2.35	26	2.14	28
Green business practices	2.30	27	2.26	26
Six Sigma*	2.29	28	1.83	31
Environmental certification	2.27	29	2.12	29
Wood drying issues	2.15	30	2.36	23
International marketing	1.84	31	2.06	30

<sup>a</sup> Items were rated from 1 (not a training need) to 5 (very important training need). Bold items were rated among the top five training needs in each state. \* Denotes significant differences between companies in Minnesota and Virginia (*t* test).

ment (3.55 and 2.44, respectively), and energy management (3.06 and 2.12, respectively). The study by Rowe et al. (1999) found some company size effects in average ratings of training needs, with larger companies rating motivating personnel, total quality management, and quality and process control higher than smaller companies. The same study found differences in responses from primary and secondary producers, with secondary manufacturers rating training in motivating personnel and total quality management higher than primary manufacturers.

In a follow-up question, participants were asked to indicate the functional area that presented the most important training need, from a list of five areas. Results are summarized in Table 8. Manufacturing operations and marketing and sales were the top two functional areas with the greatest need of training, in both Minnesota and Virginia. A considerably larger percentage of companies in Minnesota than in Virginia indicated general business management as the greatest need (12.3% and 5.0%, respectively), and procurement of raw materials was selected by a higher percentage of Virginia participants (14.9% and 4.1%), possibly due to the larger representation of primary manufacturers in the Virginia sample.

Companies that chose “other” indicated the following training needs: green certifications, moisture content and kiln drying, maintenance, social media marketing, product development, coaching leadership and human resource management, lumber inspection/grading, and problem solving for craftspeople.

The effectiveness of a number of training delivery methods were rated by participants (Table 9) on a scale of 1 to 5, where 1 = the least effective method and 5 = the most effective method. The only significant difference between responses in the two states occurred in online, self-directed studies, with companies in Virginia rating this method significantly higher than companies in Minnesota, although average rankings were relatively low (2.95 and 2.35, respectively). There was no business-type effect in regards to training delivery method for participants in both Minnesota and Virginia (ANOVA), but company size did have an effect on responses about personal visits (*t* test, small companies rated personal visits lower than medium/large companies, 4.6 compared with 3.6). For participants in Virginia, there were significant differences in ratings of personal visits and webinars as delivery methods between small and medium/large companies, with the latter group rating the personal visits higher than small companies (4.5 and 3.8, respectively). Conversely, small companies considered webinars more effective than medium/large companies (2.8 and 1.9, respectively).

Regarding current suppliers of training (Table 10), there were no significant differences between participants in Minnesota and Virginia, nor were there any effects of business type or company size on responses. Private industry, trade associations, and consultants were the most frequent responses, cooperative extension and universities were the least used suppliers of training. Other suppliers included in-house training, Web site search, and no training.

Participants were also asked whether they currently have a summer internship or co-op program for students from surrounding universities. Only 16 percent of companies in Minnesota and 18 percent in Virginia answered positively. Medium and large companies are more likely to have an internship or co-op program than smaller companies in both states (Pearson chi-square test).

Finally, the survey asked participants to share comments on educational areas or programs that they would like the universities to provide for the industry. Many participants used the question to suggest training topics, such as machine operation, fundamentals of woodworking tools and methods, impacts of regulations on costs, safety and regulatory compliance, and restoration of historic structures. Another frequent theme in the comment section was the need for skilled employees in the manufacturing trade. One participant pointed to the gap left by trade schools, and the need for trade groups to engage in extensive training of apprentices. Lastly, a short-course format was suggested for topics such as sales, marketing, industrial distribution, industry trends, and resource management issues

## Company Interviews

Personal interviews were conducted with wood products firms in Virginia the third week of July 2012 and in Minnesota the last week of July. Company executives were contacted before the interview to inform them about the purpose of the visit and that they would be asked a number of questions as a follow-up to our electronic survey. The

Table 7.—Differences in training needs importance rating in companies of different size classes in Virginia and Minnesota.<sup>a</sup>

Training need	Minnesota			Virginia		
	Overall	Small	Medium/large	Overall	Small	Medium/large
Product promotion	2.75	2.55	3.00	2.69	2.52	2.91
Sales abilities	3.04	2.82	3.35	3.05	2.76*	3.46*
Quality and process control	3.36	3.11*	3.69*	3.13	2.77*	3.59*
Public relations	2.69	2.40*	3.07*	2.57	2.66	2.45
Plant maintenance	3.18	2.92*	3.52*	2.83	2.33*	3.44*
Business planning	2.88	2.55*	3.21*	2.81	2.67	3.00
Marketing	3.04	2.79*	3.38*	2.89	2.77	3.06
International marketing	1.84	1.63	2.10	2.06	1.89	2.30
Energy management	2.52	2.13*	3.03*	2.53	2.12*	3.06*
Lean manufacturing	3.12	2.87*	3.45*	2.40	2.07*	2.84*
E-commerce	2.39	2.34	2.38	2.26	2.28	2.23
Product costing	3.10	2.84*	3.45*	2.78	2.56	3.00
Green business practices	2.33	2.03*	2.66*	2.26	2.16	2.33
Environmental certification	2.27	2.00*	2.62*	2.12	1.75*	2.59*
Branding	2.64	2.29*	3.10*	2.31	2.05*	2.66*
Motivating personnel	3.18	2.84*	3.62*	2.63	2.34*	3.00*
Product distribution	2.75	2.63	2.90	2.43	2.14*	2.75*
Inventory control	2.85	2.58*	3.21*	2.73	2.46*	3.12*
Production management	3.12	2.76*	3.59*	2.77	2.42*	3.24*
Process improvement	3.32	3.00*	3.72*	2.92	2.44*	3.55*
Finding market information	2.71	2.54	2.93	2.82	2.84	2.79
Plant financial issues	2.77	2.50*	3.10*	2.51	2.28	2.82
Strategic management	2.91	2.61*	3.28*	2.63	2.30*	3.10*
Total quality management	3.25	2.83*	3.66*	2.70	2.40*	3.03*
Basic problem solving skills	3.11	2.83*	3.46*	2.67	2.36*	3.00*
Cleaner production technologies	2.42	2.19*	2.71*	2.14	2.02	2.29
Leadership	3.08	2.94	3.25	2.70	2.44*	3.07*
Six Sigma	2.33	1.83*	2.96*	1.83	1.55*	2.24*
Wood drying issues	2.15	1.92	2.45	2.36	2.18	2.59
General problem solving	3.09	2.95	3.28	2.71	2.50	3.00
Product development	2.78	2.65	2.96	2.32	2.24	2.42

<sup>a</sup> Items were rated from 1 (not a training need) to 5 (very important training need). \* Denotes significant differences between companies of different size classes (*t* test).

Table 8.—Functional area with greatest training need.<sup>a</sup>

Functional area of greatest training need	Minnesota companies		Virginia companies	
	%	Rank	%	Rank
Manufacturing operations	41.1	1	25.7	2
Marketing/sales	30.1	2	26.7	1
General business management	12.3	3	5.0	4
Procurement of raw materials	4.1	4	14.9	3
Logistics and shipping	0.0	5	4.0	5
Other (please specify)	5.5		6.9	

<sup>a</sup> Percentage calculated based on 73 responses in Minnesota and 101 in Virginia.

Table 9.—Effectiveness of training delivery methods.<sup>a</sup>

Training delivery method	Minnesota		Virginia	
	Mean	Rank	Mean	Rank
Personal visits	4.05	1	4.08	1
Short courses	3.54	2	3.47	2
Webinars	2.50	3	2.47	4
Online, self-directed studies*	2.35	5	2.95	3
Training manuals	2.38	4	2.30	5

<sup>a</sup> Items were rated as 1 (least effective method) to 5 (most effective method). \* Denotes significant differences between companies of different regions (*t* test).

Table 10.—Organizations providing training.<sup>a</sup>

Organization providing training	Minnesota companies		Virginia companies	
	No.	%	No.	%
Private industry	34	46.6	33	32.7
Trade associations	31	42.5	34	33.7
Consultants	21	28.8	22	21.8
State/Federal government	10	13.7	13	12.9
Cooperative extension	7	9.6	10	9.9
Universities (other than extension)	5	6.8	15	14.9
Other (please specify)	2	2.7	9	8.9

<sup>a</sup> Multiple responses were possible. Percentage calculated based on 73 responses in Minnesota and 101 in Virginia. No significant differences were found between responses from participants in both states (Pearson chi-square).

most common responses were grouped and are presented in Table 11.

The first question asked was about the top three business issues affecting companies' profitability today. In Virginia, the top mentioned items included market conditions and the economy, followed by government regulations and its additional costs, and finally the availability and price of raw materials. In Minnesota, the top mentioned items were market conditions, finding qualified labor, and government regulations. In deeper discussion on the labor issue in both states, it was an issue of finding individuals who had a good work ethic and had the ability and desire to learn.

Participants were asked to identify the primary performance measurements used by the company. In Virginia, the top responses were production goals, profit goals, and quality. Safety was mentioned quite often in conversations as a major priority and was tracked, but it was not considered a performance goal by many. In Minnesota, the top responses were safety, profit goals, and quality. These were followed closely by productivity measurements. In both cases quality was measured in shop by standard tests and by customer satisfaction measurements.

We asked respondents to identify one subject area on which they would send their management employees to get trained. In Virginia, the most common responses were general management skills such as team building, customer relationships, and people skills. This was followed by manufacturing technology and operations management. In Minnesota, interviewees responded that they would send employees to project management, materials management,

and general supervisory skills training. These were followed by human resource management and change management subjects. These individuals were also asked what type of courses they would send their labor force to. In Virginia, lean manufacturing and supervisory skills were the most common responses. In Minnesota, machine operating, technology expertise, and cross training were the top responses. We asked what one subject area would be the greatest benefit to the company. Virginia participants responded that basic management skills, human relations, and marketing were the most common. In Minnesota, project management, marketing, and basic management skills were the most common responses.

We asked these managers what subject areas should be covered in a training manual or short book on business management for the forest products industry. Individuals from both states indicated that wood as a raw material, operations management, lean manufacturing, human resource management, financial management, marketing, organizational structure, and distribution should be included in such a book. Specific issues that came up included the challenges of operating a family-owned business. One individual stated, "We are a family-owned business, but we are no longer a family." Innovation and adapting to change was mentioned in both states as subjects that should be included. Finally, the concept of wood being an environmentally friendly material and how to spread that word to their customer should be included.

When asked about the best way to deliver training, one-to-one personal interaction was mentioned most, followed

Table 11.—Summary of interview responses; answers were categorized.

Topic	Minnesota	Virginia
Top business issues affecting companies	Market conditions, finding qualified labor, government regulations	Market conditions and economy, government regulations costs, raw material price and availability
Primary performance measures	Safety, profit goals, quality	Production goals, profit goals, quality
Training area for management employees	Project management, materials management, general supervisory skills	General management skills, manufacturing technology, operations management
Training area for hourly employees	Machine operations, technology expertise, cross-training	Lean manufacturing, supervisory skills
Subject area with the most benefit for company	Project management, marketing, basic management skills	Project management skills, human relations, marketing
Areas to be covered in training manual <sup>a</sup>	Wood as a raw material, operations management, lean manufacturing, human resource management, financial management, marketing, organizational structure, distribution	
Best delivery method for training <sup>a</sup>	One-to-one on-sight personal interaction, short courses, webinars	
Current providers of training <sup>a</sup>	Trade associations, insurance companies, vendors	

<sup>a</sup> Same for both states.



by short-courses and then webinars. Training via DVDs is common in some firms. One innovative method was a company “book club” for the hourly labor force. The manager said it was one of the best ideas for building relationships and sharing current business concepts among his employees that they had seen. The most common responses about who was providing training were trade associations, insurance companies, and vendors. Some community colleges and manufacturing technology centers were also mentioned. In each state, cooperative extension was mentioned as providing some training but not as frequently as the other organizations.

It is worth commenting on some differences and similarities found between the results from the company interviews and the results for comparable questions in the online survey. Regarding business factors that most affect participants’ businesses, two items that received relatively low importance scores in the online survey were mentioned repeatedly during the in-person interviews: government regulations and availability of qualified labor. Differences between responses about the most important training needs are more difficult to analyze because these needs were not segregated depending on the type of employee (management or hourly). When respondents were asked about the one training area that would most benefit the company, both online survey and interview respondents indicated marketing and business management among the top concerns; however, interview participants also mentioned project management and human relations as areas of great importance, and survey respondents indicated manufacturing among the top two training areas. Lastly, both survey and interview respondents coincided in that personal interaction was the most effective training delivery method.

Finally, these executives were asked why they believe they have been successful during the current recession. In Virginia, they felt that being customer focused and flexible, being diversified, and having good financial management were the key issues. In Minnesota, they believed having high quality and good customer relationships, being “lean,” controlling costs, and being flexible were their success factors. It is worth noting that “flexibility” was frequently cited as strength, and when respondents were further inquired about this, they noted that companies that are willing to work with different materials (in addition to wood) and making different products with a high degree of customization are more likely to succeed in the current market conditions.

## Summary and Conclusions

A study was conducted in summer of 2012 to assess the educational needs of forest products companies in Minnesota and Virginia. A combination of Web survey and personal interviews was used as methodology. Companies indicated that the factors that most affected their business were the housing market, transportation and energy costs, and the changing nature of customer demand. Interestingly, globalization was not rated highly by the participants, given the large losses in market share to low-cost suppliers during the last decade. Also, company size had a significant effect on companies’ responses.

Major training needs reported by participants were quality and process control, process improvement, maintenance, sales, marketing, and process improvement, although there were differences in response between regions and with

company size. Somewhat surprisingly given the great attention given to environmental concerns during the last decade, environmentally friendly business practices, such as green building or environmental certification, were rated low on the scale. When companies were asked to identify the single most important area for training, the response was consistent; manufacturing operations and marketing and sales were the preferred subject areas for participants. As for training delivery method, companies prefer personal visits and short courses. Online courses were rated high only in Virginia. Most participant companies indicated that they get training from trade associations, private industry, and consultants. Only about one in seven companies had an internship or co-op program, which suggests an opportunity for universities.

This research indicates a continued need for educational training for the wood products industry. The training needs vary by location and company size, and to a lesser degree by type of firm. Companies believe that although personal contact (visit or short courses) is the best way to deliver training, more firms are using technology to meet their needs. The top-rated needs were in the manufacturing and marketing areas based on the questionnaire, but these fell more into the general management area when addressed in personal interviews. During personal interviews there were repeated requests for a qualified trained labor force. Even with an excess of 8 percent unemployment, these managers indicated that it was hard to find “good people” who have a good work ethic and are trainable. Other topics that came up repeatedly during the interviews were the need to promote wood as an environmentally friendly material and the need to be flexible, especially in challenging times for the industry.

Training and educational materials emphasizing process improvement, quality and process control, maintenance, marketing, and sales should be the highest priorities for those organizations providing training to the forest products industry. Results also indicate that training providers must be aware that educational training varies by location, size of company, and industry subsector.

## Acknowledgments

The authors thank Travis Smith for his support in gathering company data for this study. This research was supported by the USDA Forest Service, Northern Research Station, Princeton, West Virginia, and the Wood Education and Resource Center, Princeton, West Virginia.

## Literature Cited

- Alreck, P. L. and R. B. Settle. 2004. *The Survey Research Handbook*. Vol. xxv. 3rd ed. McGraw-Hill/Irwin, Boston. 463 pp.
- Anonymous. 2007. Special report. Trade’s victims: In the shadow of prosperity: Hard truths about helping the losers from globalisation. *The Economist* 382:29.
- Aragón-Sánchez, A., I. Barba-Aragón, and R. Sanz-Valle. 2003. Effects of training on business results. *Int. J. Hum. Resour. Manag.* 14(6):956–980.
- Bowe, S., R. Smith, J. Massey, and E. Hansen. 1999. A methodology for determining extension constituent needs: A case analysis in the forest products industry. *J. Extension* 37(4):12.
- Bratkovich, S. M. and L. E. Miller. 1993. Perceived educational needs of innovative Ohio sawmill operators. *Forest Prod. J.* 43(3):35–40.
- Buehlmann, U., M. Bumgardner, A. Schuler, and M. Barford. 2007. Assessing the impacts of global competition on the Appalachian hardwood industry. *Forest Prod. J.* 57(3):89–93.

- Buehlmann, U., M. Bumgardner, A. Schuler, and J. Crissey. 2008. Managing the downturn. *Modern Woodworking* April:40–49.
- Buehlmann, U. and A. Schuler. 2009. The U. S. household furniture industry: Status and opportunities. *Forest Prod. J.* 59(9):20–28.
- Dalecki, M. G., J. C. Whitehead, and G. C. Blomquist. 1993. Sample non-response bias and aggregate benefits in contingent valuation: An examination of early, late and non-respondents. *J. Environ. Manag.* 38(2):133–143.
- Dillman, D. A., J. D. Smyth, and L. M. Christian. 2008. *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method*. 3rd ed. Wiley, Hoboken, New Jersey.
- Etter, J.-F. and T. V. Perneger. 1997. Analysis of non-response bias in a mailed health survey. *J. Clin. Epidemiol.* 50(10):1123–1128.
- Hansen, E. and R. Smith. 1997. Assessing educational needs of the forest products industry in Oregon and Virginia. *Forest Prod. J.* 47(4):36–42.
- Kaplowitz, M. D., T. D. Hadlock, and R. Levine. 2004. A comparison of web and mail survey response rates. *Public Opin. Q.* 68(1):94–101.
- Lahaut, V. M. H. C. J., H. A. M. Jansen, D. van de Mheen, H. F. L. Garretsen, J. E. E. Verdurmen, and A. van Dijk. 2003. Estimating non-response bias in a survey on alcohol consumption: Comparison of response waves. *Alcohol Alcohol.* 38(2):128–134.
- Quesada, H. J. and R. Gazo. 2006. Mass layoffs and plant closures in the U.S. wood products and furniture manufacturing industries. *Forest Prod. J.* 56(10):101–106.
- Rephann, T. J. 2008. *The economic impact of agriculture and forestry on the Commonwealth of Virginia*. Weldon Cooper Center for Public Service, University of Virginia, Charlottesville. 69 pp.
- Schuler, A. and U. Buehlmann. 2003. Identifying future competitive business strategies for the U.S. residential wood furniture industry: Benchmarking and paradigm shifts. USDA Forest Service, Northeastern Research Station, Newton Square, Pennsylvania. 19 pp.
- Skurla, J. A., J. Jacobson, T. Kasim, B. Resch, T. Genest, and V. Almquist-Minko. 2010. *The economic impact of Minnesota's forestry-related industries on the State of Minnesota*. Minnesota Department of Natural Resources, Division of Forestry, Duluth. 32 pp.
- Smith, R., R. Bush, and A. Hammett. 1998. Evaluating the subject needs for wood science and forest products curricula. *Wood Fiber Sci.* 30(1):105–112.
- Thomas, J. K., D. E. Albrecht, J. C. Lee, and R. Klinoff. 1986. Continuing education in industry. *J. Forestry* 84(3):42–43.
- Watson, D., J. Galway, P. J. O'Connell, and H. Russell. 2009. *The Changing Workplace: A Survey of Employers' Views and Experiences*. Vol. 1: Employers The National Workplace Surveys 2009 (Vol. 6). National Centre for Partnership and Performance, Dublin.
- Woodall, C. W., P. J. Ince, K. E. Skog, F. X. Aguilar, C. E. Keegan, C. B. Sorenson, D. G. Hodges, and W. B. Smith. 2011. An overview of the forest products sector downturn in the United States. *Forest Prod. J.* 61(8):595–603.
- Wright, K. B. 2005. Researching internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *J. Comput.-Mediated Commun.* 10(3):article 11.