

Market and Labor Force Factors  
in the Growth of the Wood Products Industry  
in Rural Pennsylvania



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# Market and Labor Force Factors in the Growth of the Wood Products Industry in Rural Pennsylvania

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# Executive Summary

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Despite an overall positive picture of employment in Pennsylvania’s wood products industry, employment growth has not been uniform among the various sectors of the industry. Particularly, the higher value-added furniture and fixtures sectors are under great pressure from an increase in competition from offshore manufacturers.

While government policy cannot reverse global and technological forces, it can help the industry adapt to challenges and opportunities. Knowledge of what Pennsylvania’s hardwood markets are, how they are changing, and where the greatest competition lies is necessary to devise strategies to maintain the market or access new markets.

The main objective of the research was to determine what markets Pennsylvania hardwood processors currently access, how these processors see their markets changing, and how they view their future. The second objective was to determine the workforce needs of the industry to respond to an increasingly competitive environment and to become more productive and efficient.

The research included analyses of secondary data as well as information from a mail survey of hardwood processors in Pennsylvania and surrounding states.

In terms of markets, the research revealed that: 88 percent of respondents had made changes in the last five years in what they produced, due mainly to changes in demand, outputs, inputs, or imports; 79 percent had seen no change in their final buyers in the last five years; 58 percent of Pennsylvania firms reported increased sales in the last five years; 75 percent of survey respondents identified local competitors and/or those within their own industry as their main competition while 19 percent of Pennsylvania firms considered imports to be main sources of competition; and for the businesses that mentioned foreign competition as a concern, two products are the most affected – low value-added saw and planing products and high value-added furniture products.

In terms of workforce needs, the research revealed that: while less than half of Pennsylvania respondents reported problems finding workers with the proper skills, 39 percent of the smallest firms and 67 percent of the largest firms had problems; the top three skills perceived to be lacking among workers were basic schooling, work ethic and technical skills; the majority of respondents preferred to train workers themselves; 76 percent of respondents had invested in new technology in the last five years; and investment in new technology required retraining for about 60 percent of all businesses.

To address the marketing and workforce needs of the industry, the researchers suggest that policy efforts focused on the different types and sizes of hardwood businesses will achieve better results than a one-size-fits-all policy. Three considerations for state government from this research are to: analyze and provide information on changing markets and how to access those markets; examine Pennsylvania’s investment assistance programs to determine if they meet the needs of the state’s hardwoods industry, including both small and large businesses; and devise a range of on-site workforce training and education programs, particularly for smaller firms.

# Introduction

While employment in Pennsylvania's traditional manufacturing and resource-based industries has declined recently, particularly in the state's rural areas, Pennsylvania's wood products industry was the only natural-resource-based industry and one of the few manufacturing industries to have employment growth. From 1990 to 2001, Pennsylvania had a net loss of more than 132,000 manufacturing jobs, and that number more than doubled over the next two years (Fuller, Shields and Smith, 2002; Pennsylvania Labor Force, May 2002 and April 2003). Meanwhile, Pennsylvania's wood products industry added jobs during this period, (Fuller, Shields and Smith, 2002). While not making up for lost jobs in other manufacturing industries, wood products firms have been an important source of employment in both rural and urban areas.

It is important to focus on the future of the wood products industry and what it needs to remain competitive in national and global markets, since this industry has the potential to support local and regional economies. For example, the wood products industry is based on a high-value, sustainable natural resource that exists in few other places. Also, the businesses using this resource are primarily small, local, owner-operated firms. As long as they can make a profit, they will stay in the area, employ local people and buy locally. The industry also provides skilled and semi-skilled manufacturing jobs necessary to diversify local labor markets. Furthermore, a 2002 study by the Pennsylvania Department of Labor and Industry's Center for Workforce Information and Analysis shows that, relative to the nation, more than half of the state's counties, both rural and urban, are highly specialized in lumber and wood products employment. This implies that these counties likely have a comparative or competitive advantage in this industry and that wood products play relatively large direct and indirect roles in the local economy of those counties.

Despite the overall positive picture of employment in Pennsylvania's wood products industry in general, employment growth among specific wood product sub-sectors has not been uniform, particularly in the higher value-added sectors. While the lumber and wood products sector added more than 6,000 jobs from 1990 to 2001 and continued to increase through early 2003, the picture in the higher value-added furniture and fixtures sector has been the opposite. Pennsylvania businesses in this sector lost more than 3,000 jobs from 1990 to 2001 and jobs continue to decline.

## Definition of the Hardwood Processing Industry

For the research, the hardwood processing industry was defined by selected Standard Industrial Classification (SIC) codes. The majority of hardwood processing industries are in SIC 24, lumber and wood products, and in SIC 25, furniture and fixtures products. Certain SIC codes within these were excluded as they dealt with softwood or products other than wood. The following are the SIC codes defined as "hardwood processing" for this research.

- 241 – Logging: Establishments primarily engaged in cutting timber and in producing rough, round, hewn, or riven primary forest or wood raw materials, or in producing wood chips in the field.
- 242 – Sawmills and Planing Mills: Establishments primarily engaged in sawing rough lumber and timber, or manufacturing hardwood dimension lumber and workings.
- 243 – Millwork, Veneer, Plywood, and Structural Wood Members: Establishments primarily engaged in manufacturing fabricated wood millwork, kitchen cabinets, veneer and plywood, and structural wood members including roof trusses. *Excluding: 2436 Softwood Veneer and Plywood – Establishments primarily engaged in producing commercial softwood veneer and plywood, from veneer produced in the same establishment or from purchased veneer.*
- 244 – Wood Containers: Establishments primarily engaged in manufacturing wood containers including: wood chests, wood boxes, pallets, skids, barrels, and tanks.
- 245 – Wood Buildings and Mobile Homes: Establishments primarily engaged in manufacturing prefabricated wood buildings, sections, and panels and also includes the manufacturing of the following structures: mobile homes, farm buildings, houses, log cabins, and saunas. *Excluding: 2451 Mobile Homes – Establishments primarily engaged in manufacturing mobile homes and nonresidential mobile buildings.*
- 2499 - Wood Products, Not Elsewhere Classified: Establishments primarily engaged in manufacturing miscellaneous wood products, not elsewhere classified.
- 2511 - Wood Household Furniture, Except Upholstered: Establishments primarily engaged in manufacturing wood household furniture commonly used in dwellings. This industry also includes establishments manufacturing camp furniture.
- 2521 - Wood Office Furniture: Establishments primarily engaged in manufacturing office furniture, chiefly of wood.
- 2531 - Public Building and Related Furniture: Establishments primarily engaged in manufacturing furniture for schools, theaters, assembly halls, churches, and libraries.
- 2541 - Wood Office and Store Fixtures, Partitions, Shelving, and Lockers: Establishments primarily engaged in manufacturing shelving, lockers, and office and store fixtures, plastic laminated fixture tops, and related fabricated products, chiefly of wood.

The furniture and fixtures sector is experiencing employment declines throughout the U.S. (Morse, 2004, and News-Record.com, 2003a).

The pressure on these higher value-added sectors, particularly furniture, is coming primarily from China, as nearly half of all wood furniture sold in the U.S. is now made in China (News-Record.com, 2003b), since labor costs in China are at about 1/20<sup>th</sup> of what they are in the U.S. (News-Record.com, 2003c).

While government policy cannot reverse global forces and technological innovations, it can help the industry to adapt to challenges and opportunities. Research can inform potential government policy and help the industry regarding two areas: changing markets, and labor force needs and constraints. First, to devise strategies to maintain the market or gain access to new markets, it is necessary to have knowledge of what Pennsylvania's hardwood markets are, how they are changing, and where the greatest competition lies.

Second, in the global economy, targeted or niche marketing is essential for higher cost producers in the U.S. Competing in mass markets with undifferentiated products is difficult, as these markets are more price sensitive, and overseas producers can produce much more inexpensively. Therefore, one means of maintaining a competitive hardwoods industry and offsetting low-cost labor in other countries is to increase productivity and efficiency.

Since a key to increasing productivity, and thus competitiveness and profits, is a more skilled and educated labor force, the following research was conducted, with two broad goals in mind: to determine what markets Pennsylvania hardwood processors currently access, how these processors see their markets changing, and how they view their future; and determine the work force needs of the industry if it is to respond to the increasingly competitive environment and become more productive and efficient.

The core methods for achieving these goals were: a review of recent studies of the industry's markets and labor force needs; an analysis of secondary employment and establishment data to examine the employment changes in the industry at the state and county levels; and surveys and interviews with hardwood processors.

## **Studies of Markets and Labor Force Needs**

### **Pennsylvania**

Compared to total employment in Pennsylvania, the hardwood processing industry is a relatively small part of the state's economy. In 1990, employment in hardwood processing reached nearly 35,000, representing 0.7 percent of the entire workforce. By 2003, employment had increased to 40,470, but still just 0.75 percent of Pennsylvania's workforce. However, the hardwood

processing industry is a vital part of the local economy in several counties. For example, in 2003, over 21 percent of the total employment in Snyder County was in the hardwood processing sector, compared to about 14 percent in 1990.

Furthermore, the growth in hardwoods employment in Pennsylvania was limited to a few sectors. From 1990 to 2003, wood kitchen cabinet makers increased employment by 1,851 workers, while wood household furniture makers and wood office furniture makers lost 1,362 and 1,551 workers, respectively. For this reason, the remainder of this section focuses on research regarding the wood furniture sub-sectors.

### **United States**

In 2003, Schuler and Buehlmann noted that the wood household furniture industry in the U.S. lost approximately one-third of its market share to importers during the past decade. They stated that imports equaled about 53 percent of domestic production. In contrast to the wood furniture industry, kitchen cabinet manufacturing is strong and growing. The cabinet industry is projected to grow by about 7 percent annually through 2006 (Plantz, 2004).

One of the major reasons for the loss of market share by domestic wood manufacturers is economic globalization. When domestic industries compete in the global market arena, they tend to be less profitable and competitive. In many cases, globalization exposes weaknesses in the domestic industry. Another reason for market share loss is the lack of a cohesive industry-wide marketing strategy. This fragmentation is evidenced by the fact that the top 10 U.S. furniture retailers capture only 16 percent of the market. To address this marketing issue, producers are beginning to market directly to the consumer through branded retail outlets because consumers often prefer buying furniture from branded franchise stores to department and specialty stores or mass marketing merchants and because successful companies can be best categorized by brand names (Bryson et al., 2003).

Other contributing reasons for the increase in imports are the improvement in speed and efficiency of shipping among continents, and the faster growing U.S. economy has created an increase in imports of foreign products and an appreciation of the U.S. dollar. This change made imports cheaper for Americans and created additional incentives for foreign companies to export to the U.S.

On the demand side of the equation, several favorable trends will increase demand for wood household furniture over the next decade in the U.S.: the average square feet of living area in a home has increased since the 1950s; remodeling activity has been strong in the last decade, as an estimated 30 percent of housing units are at least 30 years old; and baby boomers are now in their peak earning and spending years. Baby boomers have been identified by many research studies to have unique

tastes and a dislike for mass products. They are more focused on customized products that offer unique satisfaction of their needs (Schuler and Buehlmann, 2003).

The kitchen cabinet segment of the wood products industry has taken advantage of demographic trends and focused on customizing their products, so the industry is strong and growing. The size of the average kitchen is increasing, and the kitchen remodeling business has doubled over the last decade. Kitchen cabinet makers are staying competitive by offering quick delivery and more choices in terms of styles, wood finishes, and hardware options (Plantz, 2004).

### Global competition

China, Canada and Mexico are the fastest growing exporters of wood furniture to the U.S. (Schuler et al., 2001). China is the dominant wood furniture source providing one-third of U.S. imports, up from close to zero a decade ago. In the longer term, new major competitors may be arising in Russia and India (Plantz, 2004).

In 2000, more than 50,000 Chinese furniture manufacturers employed approximately 50 million workers and produced \$15 billion worth of goods, a 15 percent increase over the previous year. Chinese exports tripled from 1994 to 2001, replacing Italy as the largest furniture exporter in the world and Canada as the largest exporter to the U.S. In 2001, China exported \$2.8 billion of furniture to the U.S., which represented 30 percent of total U.S. furniture imports. Since 1996, case goods (defined as any home furnishing product made with wood) imports from China have grown at an annual rate of more than 35 percent, reaching approximately \$1.8 billion in 2001. Case goods accounted for approximately 47 percent of total U.S. furniture shipments in 2001, with wholesale shipments of residential case goods products approximating \$10.9 billion in 2001 (Bryson et al., 2003).

According to a report by the University of North Carolina at Chapel Hill Business School, many Chinese manufacturers are increasing their wood furniture capacity for the U.S. market by 25 to 30 percent a year, with analysts expecting that U.S. and European markets will absorb about 20 to 30 percent of output. At this rate of growth, however, there is speculation that Chinese furniture production is heading towards overproduction. Increasingly, Chinese manufacturers are adopting modern technologies that bring cost savings of 30 to 40 percent in raw materials alone. Most of the lumber used by Chinese manufacturers is sourced through U.S. trading agents.

A weakness of Chinese furniture production is the ability to produce quality finished products. Industry analysts agree that low quality finishing and final assembly could make a good product into a marginal one, decreasing the price in the market. As a consequence, many U.S. furniture importers source unfinished furniture and finish the product in the U.S. However, China is addressing this issue by hiring U.S. specialists to

improve quality standards (Bryson et al., 2003).

It is a common belief that Chinese furniture manufacturers only enjoy a competitive advantage through lower labor cost. BB&T Capital Markets estimates there is a 20:1 differential in factory worker wages between eastern Asia and the U.S. (Bryson et al., 2003). China's overabundant supply of labor puts enough downward pressure on wages that wage rates may not increase in the near future. Another important cost differential is overhead, as Chinese manufacturers do not have to follow the same strict rules and regulations as U.S. manufacturers, such as regulations concerning worker safety and building codes (Bryson et al., 2003).

A typical Chinese furniture manufacturer takes advantage of the abundant supply of low-cost labor and employs a very labor-intensive process. On average, a Chinese manufacturer has a limited amount of technology. As a consequence, labor productivity remains comparatively low with gross value being added with each employee averaging around 4 percent of that in an American company (Robb and Xie, 2003).

### Strategies to compete in the wood furniture industry

Several authors have suggested a range of strategies to deal with the above mentioned trends in the wood furniture industry.

There are several key components in a strategy to improve competitiveness by U.S. manufacturers. It is especially important not to compete solely on price. Because cost-saving technologies are readily available around the world, lowering production costs will not rescue the industry. Although productivity and value-added per employee is larger in the U.S., it is more than offset by other factors like labor costs. Additionally, competing solely on price demolishes the vision that furniture makes a home unique and special. Thus, a key strategic theory is to differentiate products to create an image.

One key to differentiating one's products is to provide speedy delivery while providing high quality and customer satisfaction. To capitalize on quick delivery, there is tremendous opportunity in Pennsylvania to take advantage of proximity to markets and produce furniture locally. The U.S. East Coast has one of the largest stocks of the world's most sought after wood species for furniture production; however, in many cases, raw wood is exported to competitors overseas who make the furniture and sell it back to the U.S. Even with modern shipping technology, it takes several months from when an order is placed in the U.S. to the delivery of the furniture from an overseas manufacturer (Schuler and Buehlmann, 2003).

Next, mass customization allows companies to practice mass production while being able to customize the product to a customer's specification without losing cost efficiency. For mass customization to work, manufactur-

ers need to create strategic alliances with domestic and overseas manufacturers who specialize in basic components that are interchangeable within a product range. Customized products, combined with speed of delivery and high quality, are sustainable competitive advantages that offshore competitors will not be able to overcome easily (Schuler and Buehlmann, 2003).

Another integral part of successful wood manufacturing is up-to-date equipment and infrastructure that allow the producer to build-to-order and charge a premium price. However, the lack of reinvestment in manufacturing plants has left many companies with outdated machinery with high set-up times and low interchangeability, which makes customization less efficient. The U.S. furniture industry needs to be on top of innovation to fulfill customers' needs and help companies achieve a competitive advantage.

Bryson et al. (2003) identified five strategies that companies have pursued in the past:

1. U.S. manufacturers source products from overseas with the help of an import agent located in the country of origin. The agent acts either as a company representative to ensure that products meet all specifications or as an import agent that locates the company with the quickest delivery time.
2. U.S. manufacturers produce furniture overseas to take advantage of lower production cost. Building a manufacturing plant overseas ensures better control of the production process to increase quality and to secure quick delivery times. However, with direct investment comes the risk of being dependent on a foreign government's actions.
3. U.S. retailers buy directly from the overseas manufacturer. The advantage of sourcing goods directly are lower cost, shorter transit time, and better communication between retailer and producer. Due to the cost of communication, this model primarily works for very large retailers and larger manufacturers.
4. U.S. import agents source products overseas and sell them directly to small U.S. retailers. Import agents buy furniture overseas and store them in their own warehouses while selling them to smaller domestic retailers. The risk of overstocking and the tremendous amount of capital required have limited this strategy to a few players in the market.
5. A mix of domestically produced goods and at least one of the above four strategies can take advantage of inexpensive labor overseas and the finishing expertise in the U.S.

Sampson (2003) portrayed a Pennsylvania company that focuses heavily on producing high quality customized furniture. The key to the company's success is its workers. According to the owner, the talent of his workers translates directly to what he can charge for the furniture. With higher levels of woodworking skill, fewer competitors exist.

Compared to foreign competitors, U.S. workers have a

competitive advantage in design and finishing. However, as Schuler and Buehlmann (2003) point out, the industry must attract, educate, and retain young, talented furniture makers and train them in the most crucial aspects of furniture making, design and finishing so that the quality is consistently high and their product is innovative. They further point out that educational institutions that teach woodworking and furniture makers are having difficulty finding talented people. Above all, smart, well-educated and motivated workers are as important to success in the furniture industry as technology and marketing strategies.

In sum, studies of the U.S. furniture market stress that the American customer wants high quality customized furniture. So far, foreign competitors have not been able to provide high quality furniture on a consistent basis, meaning that U.S. furniture makers have a competitive advantage in making high quality and well-designed innovative furniture.

## **The Role of the Hardwoods Industry in Pennsylvania and its Counties**

Data in this section delineate hardwoods employment and establishments and are compiled from the Pennsylvania Department of Labor and Industry's ES202 data set.

### **Employment**

The hardwoods industry constitutes a relatively small sector of Pennsylvania's total employment. In 1990, total employment in Pennsylvania was about 5 million while employment in lumber and wood products and furniture and fixtures was nearly 35,000, representing less than 1 percent of the state's workforce. By 2003, total employment in Pennsylvania had increased more than 8 percent to nearly 5.5 million, and employment in hardwoods increased by nearly 16 percent to 40,470, but still less than 1 percent of total employment.

Nevertheless, the hardwoods industry is a vital part of the local economy in several Pennsylvania counties. For example, in 2003, Snyder County's hardwoods industry represented 21 percent of total county employment.

In raw numbers, Lancaster County had the largest employment in the industry, with 3,714 employees in 2003, representing nearly 2 percent of total employment in the county. Lancaster was followed closely in 2003 by Snyder County with 3,589. The top 12 counties in hardwoods employment made up more than half of the state's hardwoods employment in both 1990 and 2003.

With regard to more specific industries, in Lancaster and Snyder counties, 59 percent and 50 percent, respectively, of hardwoods employment was in wood kitchen cabinets. In Union County, 40 percent of hardwoods employment was in prefabricated wood buildings, and 33 percent was in wood kitchen cabinets. In Lycoming County, 29 percent of employment in the hardwoods industry was in prefabricated wood buildings, and

another 34 percent was in public buildings furniture.

### Employment change

From 1990 to 2003, growth in hardwoods contributed 1.35 percent to the total increase in the state's labor force.

Snyder County's hardwoods workforce saw the largest numeric increase of nearly 1,500 employees, the majority of whom were added to hardwood dimension and flooring mills, prefabricated wood buildings, and kitchen cabinets. Lancaster and Lycoming counties followed with increases of about 920 and 790, respectively. Lycoming County's increase in employment can be attributed to prefabricated wood buildings and public buildings furniture while Lancaster County's employment growth is due mainly to the growth in wood kitchen cabinets. In some counties, employment decreased between 1990 and 2003. Montgomery County, for example, had the third largest total employment in 1990 with 1,794, but by 2003 the number dropped by about half to 891.

**Hardwoods Employment as a Percentage of Total County Employment, 2003**



### Establishments

From 1990 to 2003, Pennsylvania saw a net gain of 96 hardwood establishments. Thirty-three counties had gains, 29 counties had losses, and five counties had no change or no data available. Lancaster and Chester counties had the largest net gains of 39 and 19 establishments, respectively, and Philadelphia had the largest net loss of 21 establishments.

In most employment size categories, the number of establishments increased, even though employment may have decreased. The largest increase in the number of establishments was in the 50-to-99-employee category, in both the 1990-2003 and 2000-2003 time periods, with 69 and 33 additional establishments, respectively. The largest size class, 250 or more employees, showed a considerable decline in the number of establishments in both time periods, as did the 100-to-249 class from 2000 to 2003. Because employment in these categories increased, this trend indicates an increase in the size of the largest establishments while the number of establishments decreased.

**Changes in Hardwoods Employment by Employment Size, 1990, 2000 and 2003**

Employment Size (number of employees)	Total Employment			Change		
	1990	2000	2003	1990-2000	2000-2003	1990-2003
1 to 9	3,507	3,588	3,570	2.3%	-0.5%	1.8%
10 to 19	3,692	4,342	4,251	17.6%	-2.1%	15.2%
20 to 49	6,950	6,834	6,506	-1.7%	-4.8%	-6.4%
50 to 99	5,350	6,974	6,274	30.4%	-10.0%	17.3%
100 to 249	7,293	8,702	8,464	19.3%	-2.7%	16.1%
250 or more	8,136	10,899	11,413	34.0%	4.7%	40.2%

**Hardwoods Employment by SIC, 1990 and 2003**

SIC	Description	1990	2003	# Change, 1990-2003	% Change, 1990-2003
SIC 2434	Wood Kitchen Cabinets	7,248	9,099	1,851	25.5%
SIC 2421	Saw and Planing Mills	5,594	5,347	-247	-4.4%
SIC 2452	Prefabricated Wood Buildings	4,304	5,162	858	19.9%
SIC 2511	Wood Household Furniture	4,013	3,591	-422	-10.5%
SIC 2431	Millwork	2,351	2,658	277	11.8%
SIC 2521	Wood Office Furniture	2,144	2,651	507	23.6%
SIC 2448	Wood Pallets and Skids	1,911	2,499	588	30.8%
SIC 2541	Wood Office and Store Fixtures	1,699	2,125	426	25.1%
SIC 2499	Wood Products, Not Elsewhere Classified	1,652	2,112	450	27.1%
SIC 2426	Hardwood Dimension and Flooring Mills	1,550	1,965	396	24.9%
SIC 2439	Structural Wood Members	912	1,351	439	48.1%
SIC 2435	Hardwood Veneer and Plywood	811	1,016	205	25.3%
SIC 2531	Public Building Furniture	404	593	189	46.8%
SIC 2441	Nailed Wood Boxes and Shook	143	150	7	4.9%
SIC 2449	Wood Containers	71	71	0	0.0%
SIC 2429	Special Product Saw Mills	41	69	28	68.3%
	<b>Total</b>	<b>34,927</b>	<b>40,479</b>	<b>5,552</b>	<b>15.9%</b>

### Summary of the role of hardwood processing in Pennsylvania and its counties

While employment in the hardwood processing industries is not significant at the state level, for several counties these industries are important components of the economy. Rural counties overall grew in employment in the hardwood processing industries between 1990 and 2003, while in urban counties employment decreased.

Looking at growth by SIC code showed employment in both wood office and wood household furniture decreasing significantly between 1990 and 2003. At the same time, employment in wood kitchen cabinets increased by 26 percent. These findings coincide with the 2002 study by the Pennsylvania Department of Labor and Industry that identified two major trends in the wood processing industries in the state. While the largest number of workers tend to be located in more populated areas, the counties with the largest concentration of hardwood processing workers tend to be in rural areas in central Pennsylvania, where access to raw materials is readily available.

## Survey of Hardwood Processors

As noted earlier, this research employed two methods to achieve its objectives. The first was a review of previous research and an analysis of secondary data. The second, which is described in the following section, was a mail survey of wood processors in Pennsylvania and the surrounding states of Maryland, New York, Ohio and West Virginia. The survey work was conducted in the summer and fall of 2004.

### Survey methodology

The sample was obtained from the Pennsylvania Hardwoods Development Council's subset of Labor and Industry's ES202 database. Approximately 95 percent of the wage and salary civilian labor force and 98 percent of the non-agricultural employment in Pennsylvania are covered in the ES202 database. Of the original sample of 700 firms drawn, 89 were eliminated for an actual sample size of 611 firms. The total response rate was 34 percent. Half of the respondents were from establishments with fewer than 10 employees, and 83 percent had fewer than 50 employees.

### Survey results

#### General characteristics of hardwood processing businesses

Sixty-three percent of businesses classified themselves as corporations, 8 percent classified themselves as partnerships, 27 percent as individually owned, and 1 percent as "other." This varied slightly by Pennsylvania and non-Pennsylvania businesses; 64 percent of in-state firms identified themselves as corporations while 59 percent of other state firms classified themselves as such. A larger percent of non-PA firms were individually owned, 34 vs. 24 percent.

### Hardwoods Establishments by Employment Size, 1990-2003

Employment Class	1990	2000	2003	Change 1990-2003	Change 2000-2003
1 to 9 Employees	141	133	153	8.5%	15.0%
10 to 19 Employees	89	108	100	12.4%	-7.1%
20 to 49 Employees	258	277	286	10.9%	3.3%
50 to 99 Employees	267	303	336	25.8%	10.9%
100 to 249 Employees	446	521	464	4.0%	-10.9%
250 or more Employees	240	228	199	-17.1%	-12.7%

### Hardwoods Establishments by County, 1990-2003

County	Number of Establishments			Percent Change 1990-2003
	1990	2000	2003	
Adams	19	19	22	16%
Allegheny	77	78	80	4%
Armstrong	5	16	12	160%
Beaver	9	9	6	-33%
Bedford	28	26	26	-5%
Berks	45	49	49	9%
Blair	20	18	18	-10%
Bradford	14	15	16	14%
Butts	70	74	66	-6%
Butler	10	19	18	80%
Cambria	24	22	19	-21%
Cameron	4	5	3	-25%
Carbon	8	5	8	0%
Centre	17	19	19	-6%
Clearfield	28	41	47	68%
Clinton	18	18	18	0%
Clearfield	26	28	27	3%
Cleburn	12	17	13	8%
Columbia	10	9	8	-20%
Crawford	23	29	33	43%
Cumberland	10	13	14	40%
Dauphin	15	18	20	33%
Delaware	19	19	15	-21%
Elk	12	10	11	-8%
Erie	29	33	31	7%
Fayette	27	28	22	-19%
Forest	3	3	3	0%
Franklin	38	42	51	34%
Fulton	8	5	4	-50%
Greene	3	2	2	-33%
Harrington	19	13	14	-26%
Indiana	8	12	10	25%
Jefferson	17	26	21	24%
Juniata	31	37	35	13%

County	Number of Establishments			Percent Change 1990-2003
	1990	2000	2003	
Lackawanna	28	22	24	-14%
Lancaster	94	135	133	41%
Lawrence	7	8	6	-14%
Lebanon	22	24	27	23%
Lehigh	21	15	13	-38%
Luzerne	27	21	25	-21%
Lycoming	26	31	32	23%
McKean	15	21	18	15%
Mercer	20	24	25	25%
Mifflin	11	20	27	145%
Neteese	10	12	11	10%
Montgomery	52	60	60	15%
Monroe	No Data			n.a.
Northampton	19	30	30	58%
Northumberland	5	12	11	36%
Perry	7	10	8	14%
Philadelphia	65	49	45	-32%
Pike	No Data			n.a.
Pocon	12	14	11	-6%
Schuykill	21	17	17	-19%
Snyder	23	29	32	39%
Somerset	28	23	17	-39%
Sullivan	11	8	7	-36%
Susquehanna	10	13	14	40%
Toga	11	17	18	64%
Union	8	11	12	50%
Venango	24	19	17	-29%
Warren	21	18	18	-14%
Washington	15	14	12	-20%
Wayne	22	18	21	-6%
Westmoreland	42	44	38	-10%
Wyoming	5	8	8	60%
York	51	44	46	-10%

### Survey Sample Distribution

	Actual sample	# Usable	% Usable
Maryland	27	18	66.7
New York	55	23	41.8
Ohio	84	33	39.3
West Virginia	24	10	41.7
Pennsylvania	421	126	29.9
Total	611	210	34.4

### Responses by Employment Size

Number of employees	Responses	%
< 10	109	50.7%
10 - 19	29	13.5%
20 - 49	41	19.1%
50 - 100	20	9.3%
> 100	16	7.4%

Among Pennsylvania businesses with fewer than 10 employees, about half were individually owned and about 40 percent were corporations.

Almost 90 percent of respondents were single establishment businesses as opposed to a headquarters or branch plant. Smaller businesses were more likely to be single establishments, with 96 percent of Pennsylvania and 98 percent of non-Pennsylvania firms with fewer than 10 employees being single establishments. In Pennsylvania, the break point seems to be about 50 employees, above which only slightly more than half of the firms are single establishment businesses. More than 90 percent of businesses with fewer than 50 employees are single establishments.

Pennsylvania hardwood businesses are more locationally stable than non-Pennsylvania firms. Lower

## Business Organization Type by Employment Size

Number of employees	Corporation	Partnership	Individually Owned	Other	Total respondents
Pennsylvania	64%	10%	24%	2%	124
< 10	38%	14%	48%	0%	50
10 - 19	63%	15%	19%	4%	27
20 - 49	96%	4%	0%	0%	24
50 - 100	79%	7%	7%	7%	14
> 100	100%	0%	0%	0%	9
Other states	59%	5%	34%	1%	79
< 10	40%	4%	56%	0%	45
10 - 19	100%	0%	0%	0%	6
20 - 49	89%	6%	6%	0%	18
50 - 100	67%	11%	11%	11%	9
> 100	100%	0%	0%	0%	1

percentages of Pennsylvania businesses in all size categories except the largest had moved from another location. Overall, 22 percent of in-state firms had moved compared to 39 percent of non-Pennsylvania firms. There was little difference among employment classes.

### Markets and competition of hardwood processors

#### Products

As a first step in the analysis of markets, respondent businesses were classified by the products they manufactured. Respondents with more than 50 percent of sales in one product type and less than 40 percent in any other product type were classified as a one-product business. Businesses with 50-50 or 40-30-30 splits were classified as two or more product businesses. Only 7 percent of Pennsylvania firms and 16 percent of non-Pennsylvania firms were classified as multi-product businesses.

The main conclusion drawn from this analysis was that Pennsylvania firms are more highly concentrated in the lower value-added products of saw and planing mills, millwork and containers, with 57 percent producing primarily those products versus 41 percent for non-Pennsylvania firms. Twenty percent of Pennsylvania firms focused on the highest value-added products of kitchen cabinets and furniture and fixtures vs. 39 percent of non-Pennsylvania firms. The concentration on low

value-added products by Pennsylvania firms is similar across employment size classes, but with two notable differences. The smallest firms with fewer than 50 employees are relatively more concentrated in the furniture and fixtures category, and firms with more than 100 employees are more concentrated on the higher value-added products of kitchen cabinets and buildings.

Respondents were asked if there had been changes in the last five years in the products on which they focused and why. The reasons for changes were summarized into six broad categories, namely demand, supply, output, input, imports, and no change. Only 12 percent indicated that they had made no changes in what they produced. The main reason for changes was demand related (30 percent), which includes all changes in the market place that are not in the control of the business itself, such as changes in the market and in the price of final product. Output-related reasons were given by 22 percent of respondents and included product specific changes, new products, moves to products with higher profit, taking more work, and changes in product quality. Supply changes (16 percent) included actions such as left a specific business, moved to products with less competition, increased marketing or sales effort, opened new stores, and stopped wholesaling a product. Input changes (13 percent) include changes in raw material, capital, and labor, with businesses specifically mentioning the price of raw material, purchase of new equipment or machinery, and finding labor. Only 7 percent of respondents mentioned imports as a reason they made changes in what they produced.

#### Buyers

One in four respondents (25 percent) had seen a change in their final buyers in the last five years. This was lower for Pennsylvania firms (21 percent) than in surrounding states (29 percent). Among Pennsylvania firms, the smallest change was for businesses with fewer than 10 employees, with only 11 percent indicating a change in final buyers. The percentage of businesses indicating that final buyers changed increases as employment size increases – among those with more than 100 employees, 33 percent of Pennsylvania respondents indicated that final buyers had changed in the last five years.

Sixteen percent of Pennsylvania firms reported anticipating a change in final buyers in the next five years compared to 29 percent of non-Pennsylvania firms. This varies by employment size, but not uniformly. To start, 4 percent of the smallest businesses anticipated a change. This expectation increases with employ-

## Main Products Produced by Employment Size

Number of Employees	Saw/ Planing	Millwork	Kitchen Cabinetry	Container	Building	Furniture & Fixtures	2 or more Products	Total
Total respondents	31%	9%	9%	17%	4%	19%	11%	185
Pennsylvania	39%	8%	9%	20%	5%	11%	7%	108
< 10	43%	8%	8%	10%	0%	15%	18%	40
10 - 19	37%	4%	0%	37%	7%	15%	0%	27
20 - 49	43%	10%	14%	24%	5%	0%	5%	21
50 - 100	42%	8%	8%	25%	0%	17%	0%	12
> 100	13%	25%	38%	0%	25%	0%	0%	8
Other states	19%	9%	8%	13%	4%	31%	16%	77
< 10	14%	5%	11%	5%	7%	41%	18%	44
10 - 19	50%	0%	0%	33%	0%	0%	17%	6
20 - 49	12%	24%	6%	29%	0%	18%	12%	17
50 - 100	33%	11%	0%	11%	0%	33%	11%	9
> 100	100%	0%	0%	0%	0%	0%	0%	1

### Changes in Final Buyers by Employment Size

Number of employees	Experienced change in last 5 years	Total respondents	Anticipate change in next 5 years	Total respondents
Pennsylvania	21%	120	16%	118
< 10	11%	46	4%	45
10 - 19	26%	27	19%	27
20 - 49	25%	24	25%	24
50 - 100	29%	14	36%	14
> 100	33%	9	12%	8
Other states	29%	79	29%	77
< 10	22%	46	20%	45
10 - 19	0%	6	0%	6
20 - 49	44%	18	47%	17
50 - 100	56%	9	56%	9
> 100	0%	0	0%	0

ment size until the largest class, where it declines to 12 percent.

#### Gross sales

The majority of firms, 55 percent, indicated that gross sales had increased over the last five years, while 25 percent indicated decreased sales, and 20 percent indicated no change. A higher percent of Pennsylvania firms reported increased sales (58 vs. 49 percent), and nearly equal percentages of in- and out-of-state firms reported decreases. In general, larger percentages of larger businesses indicated increased sales, except for the largest Pennsylvania firms. Only one third of Pennsylvania firms with fewer than 10 employees reported increased sales, which is much less than the percentage for other size categories. This category also had the highest percentage reporting decreased sales but was followed closely by the largest category in that respect.

#### Markets and marketing

About half of sales for all respondents are made in the state where the plant is located. Pennsylvania firms sell less in the Northeast than firms in other states (33 percent vs. 42 percent) but more in other U.S. states and foreign markets than other states (18 percent vs. 10 percent). The geographical area of sales varies considerably by firm size, although not uniformly for Pennsylvania firms.

### Changes in Gross Sales Over Last Five Years by Employment Size

Number of employees	Increase	Decrease	No Change	Total respondents
Pennsylvania	58%	25%	18%	118
< 10	33%	36%	31%	45
10 - 19	63%	22%	15%	27
20 - 49	79%	8%	13%	24
50 - 100	85%	15%	0%	13
> 100	67%	33%	0%	9
Other states	49%	26%	25%	80
< 10	41%	33%	26%	46
10 - 19	33%	33%	33%	6
20 - 49	67%	11%	22%	18
50 - 100	56%	22%	22%	9
> 100	100%	0%	0%	1

Firms with fewer than 10 employees focus primarily on local markets, with an average of 72 percent of sales made in state and another 25 percent in other Northeast states. This drops as employment size increases, with less than half of sales made in state by the 50-100 employee firms and 15 percent by firms with more than 100 employees. The largest Pennsylvania firms make half their sales in other Northeast states, 29 percent in the rest of the U.S., and six percent in foreign markets.

Respondents were asked if these geographic markets had changed in the last five years, and if so, why. No single reason for change was dominant. Of the 210 answers given (respondents could list more than one) the highest percentage of responses (8 percent) reflected changes in business climate. Because of such diversity in answers, specific responses were grouped into eight categories — change in inputs, pricing, marketing, competition, imports, production, demand, and no change. Demand reasons included change due to business climate change, population shift, new construction, and plant closings, and accounted for 30 percent of responses. Most changes in this category, except new construction, are negative changes that decrease demand. Eighteen percent of responses dealt with marketing, including marketing specifically, advertising, the Internet, customers changing, and more sales. Imports and foreign competition made up 13 percent of the responses. Another 13 percent referred to domestic competition, which included Amish and other specifically mentioned competition. Together, pricing, inputs, production, and no change make up just 27 percent of responses.

When businesses were asked to identify their two main market problems, there was again a large variety among the 263 responses (again, respondents could list more than one). The three largest market problems wood processors specifically mentioned were [low] prices (about 10 percent of responses), marketing, and raw material supply (9 percent each). While prices and marketing can be classified as common market problems for any type of business, problems with raw material supply in a state that exports lumber may be an area for further research.

The responses were summarized into six broad categories: inputs, production, demand, supply, imports, and sales. The input category accounted for 40 percent of responses and dealt with problems of raw materials, capital and labor inputs, costs of production, transportation, and poor labor pool. Demand-related market problems (20 percent) included a specific mention of demand, prices, unemployment in the area, and the economy. Almost 18 percent of responses were sales-related, including problems related to sales personnel and ordering, lack of visibility in the market, and other specific problems with marketing. Only 6 percent of responses identified imports as one of the two main market problems.

To further examine the issue of market conditions,

### Sales in Various Market Areas by Employment Size

Number of employees	In state	Other Northeast	Other U.S.	Foreign	Total respondents
Pennsylvania	50%	33%	14%	4%	114
< 10	72%	25%	3%	0%	43
10 - 19	56%	30%	9%	4%	26
20 - 49	62%	31%	6%	2%	23
50 - 100	47%	30%	21%	8%	13
> 100	15%	50%	29%	6%	9
Other states	48%	42%	8%	2%	76
< 10	84%	10%	6%	0%	43
10 - 19	49%	43%	4%	4%	5
20 - 49	54%	39%	7%	1%	18
50 - 100	35%	41%	25%	4%	9
> 100	20%	80%	0%	0%	1

businesses were asked an open-ended question to identify their competition and how it is changing. The 306 comments (respondents could give more than one answer) by 167 respondents discussed five main themes. About three-fourths (78 percent in Pennsylvania and 71 percent in surrounding states) of respondents referenced local competition and many (19 and 25 percent in Pennsylvania and other states, respectively) mentioned competition from imports. One third of those mentioning foreign competition specifically mentioned China. Fourteen percent of in-state, but just one percent of other businesses, wrote that input costs were part of their competitive problems. Sixteen percent of responses from Pennsylvania firms mentioned that their competition was not changing.

Further analysis of the 160 comments indicating local or foreign competition found that there were differences in types of competition by employment size and product make-up. In general, fewer employees meant more local competition. The greatest mentions of foreign competition were among mid-sized firms (10 to 49 employees). Also, two products, low value-added saw and planing products and the high value-added furniture products, stand out as being the most affected by foreign competition, accounting for more than three-fourths of those mentioning foreign competition as a competitive concern. This conforms to previous findings for the U.S. and North Carolina that the furniture industry is the most affected by foreign competition. The saw and planing sector, while low value-added, requires low labor skill and is subject to competition from low-wage areas.

One of the motivations for this study was the increase in foreign competition, particularly from China, in the furniture industry. About 80 percent of the businesses that mentioned China as a competitor were in the furniture and fixture or the saw and planing sectors.

### Actions Taken to Remain Competitive

	Product Quality	Customer Service	Cost Reduction/Competitive Pricing	Operating Efficiency	Change Products/Niche Marketing	Other	Total responses
Pennsylvania	16%	11%	17%	22%	16%	18%	190
Other states	19%	10%	13%	22%	21%	15%	148
Total	17%	11%	15%	22%	18%	17%	338

Businesses in the latter sector indicated that foreign importers buy so much lumber that price has increased as a consequence. Meanwhile, only 8 percent of Pennsylvania kitchen cabinet makers noted competition from China. These findings confirm the findings of other reports that Chinese imports compete mainly in the furniture industry.

A final assessment of competition was identifying what firms were doing to remain competitive. Because this was an open-ended question, more than one response was possible. Businesses use a range of approaches to remain competitive in the market, with no one approach dominating. Product quality, customer service, and changing products/niche marketing are terms used by the respondents themselves. Cost reduction/competitive pricing is made up of answers such as buying inputs in larger quantities, cutting expenses including labor, and keeping prices low or competitive. Operating efficiency includes acquiring new technology or machinery and simply becoming more efficient.

### Workforce concerns of hardwood processors

The second major objective of the survey of wood processors was to determine the workforce needs of the industry. Businesses were first asked if they had problems finding workers with the proper skills. Less than half (45 percent) of the Pennsylvania respondents reported problems, compared to 54 percent of non-Pennsylvania firms. There was some variation by the size of the business among Pennsylvania firms, with 39 percent of the smallest firms indicating that they had problems versus 67 percent of the largest firms.

The survey asked respondents to list the top three skills they perceived new employees to be lacking. Responses were categorized into basic schooling, technical skills, work ethic, general experience, and other. Schooling encompasses respondents' specific answers of math, reading, writing, basic education, and basic intelligence. Technical skills include machine skills, lumber knowledge, computer skills, skilled craftsmen, and product specific skills. Work ethic includes being responsible, dependable, motivated and loyal, having a desire to work and learn, coming to work on time, taking initiative, following directions, and other specifically-mentioned traits.

Work ethic skills were mentioned by 51 percent of respondents and were, by far, the largest type of skills lacking. Another 24 percent identified lack of schooling as one of the three main skill problems of new employees, and 15 percent indicated that employees were lacking technical skills. Experience and training made up 7 percent of all responses.

Businesses were then asked questions about training. Overall, companies preferred to train their workers themselves. This was true for 72 percent of Pennsylvania firms and 55 percent of non-Pennsylvania firms. Of the Pennsylvania

firms, external training was preferred by 17 percent, and 11 percent preferred a combination. Smaller Pennsylvania firms had a somewhat greater preference for training internally than did the larger firms. In terms of who actually provides the training, businesses primarily depend on their own staff, with some using a combination of their own staff and hired specialists. The smaller businesses tend to rely more heavily on their own staff for skills training. Only slightly more than half of the respondents indicated that they had formal training programs. In general, the larger the company, the more likely it is to provide formal training.

The survey asked respondents to choose from six predefined training categories and provided space for additional training types. While a common complaint was that employees lack basic education and skills, very few provided formal training in math and computer skills. Among Pennsylvania firms, only 17 percent provided training in math and 18 percent in computer skills. For the larger firms, a higher percentage provided formal computer training.

Almost all of the businesses that provide formal training to their employees provide training in safety, standard operating procedures, and machine-specific skills. A slightly lower percentage provides formal training in quality standards.

Businesses also were asked about the regularity of the training provided to employees. It should be noted that 39 percent of all businesses and 55 percent of businesses with fewer than 10 employees did not respond to this question. About 40 percent of respondents did not provide regular training, particularly the smaller businesses. Among Pennsylvania businesses, regular training was provided by 21 percent and training was provided "as needed" by 34 percent.

The need for training often occurs when companies invest in new technology. For this reason, hardwood producers were asked if they had invested in new technology, such as new equipment or software, in the last five years, whether this investment required re-training of employees, and, if so, what type. Overall, 76 percent of respondents had invested in new technology in the last five years. A clear pattern arises to show that, as the size of the company increases, higher percentages of businesses made investments in new technology, ranging from 59 percent of the smallest businesses to 100 percent of the largest businesses in Pennsylvania.

Investment in new technology required retraining for about 60 percent of all businesses. For Pennsylvania businesses, the percentage increased as the size of business increased, except for the largest size businesses. Less than half of the businesses with fewer than 10 employees required retraining with new investment. This steadily increased to 85 percent of the businesses with 50-100 employees, but declined to 67 percent of the largest businesses.

## Conclusions

While the hardwoods industry has suffered employment declines in some sectors and size categories in recent years, both secondary data and the survey results show an industry with the strength and potential to continue to provide employment and contribute to the economies of rural areas. From 1990 to 2003, employment in the hardwood products processing sectors increased by 16 percent statewide. Despite an overall positive picture, employment growth has not been uniform, particularly in the higher value-added sectors. Additionally, it is clear from this study that Pennsylvania hardwood processors are facing pressures from competition and technological change. Much of the pressure on the value-added furniture and fixtures sectors is from globalization of the furniture market, resulting in an increase in competition from offshore manufacturers.

In the global economy, targeted or niche marketing is essential for higher cost producers. Competing in mass markets with undifferentiated products is difficult, as these markets are more price sensitive, and overseas producers can produce products much more inexpensively. Another key to maintaining a competitive hardwoods industry is to offset low labor costs in other countries by increasing domestic labor productivity and efficiency.

Responses to the survey indicate the Pennsylvania hardwood processors are responding to changes in consumer demand and competition. Approaches include improving product quality and customer service; cutting expenses; keeping prices low or competitive; increasing operating efficiency by acquiring new technology or machinery; and changing products or increasing niche marketing.

A large majority of respondents were positive in the current and future view of the market, with 58 percent indicating that sales had increased in the last five years. Most firms also were positive in their views of future sales and in keeping their customers.

At the same time, there are market concerns that public activity could address. These include problems with obtaining raw materials at competitive prices, obtaining investment capital and labor inputs, transportation, and lack of visibility in the market. The main competition that most of the hardwood processors, especially the small firms, faced was local and/or within their own industry. This reinforces the statement that policies must be targeted.

The need for targeted policies also includes the type of product. For the businesses that mentioned foreign competition as a concern, the most affected were saw and planing products and furniture products. Over three-fourths of those mentioning foreign competition as a competitive concern had those products as their main outputs.

The survey results also indicate a role for public policy in improving the workforce. While less than half of the Pennsylvania respondents reported problems finding workers with the proper skills, there was considerable concern over the “poor labor pool.” The top three skills perceived to be lacking were basic schooling, work ethic, and technical skills.

It will take creativity and focus to address these issues. One reason is that, overall, companies, particularly smaller firms, preferred to train their workers themselves. Just over half of respondents had formal training programs, with smaller firms less likely to provide formal training.

## Policy Considerations

The most valuable role that state policy can play in maintaining strong hardwood processing businesses is to assist the industry in adapting to broad market and technology changes.

Two realities lead to the conclusion that one-size-fits-all policy for the hardwood processing industry will not likely succeed. First, the industry is varied in size and product focus. Second, changing technologies and globalization are forces that states cannot affect. Therefore, efforts that are more focused on the different types and sizes of hardwood businesses will achieve better results.

Analyze and provide information on changing markets and how to access those markets.

Most hardwood processing businesses are small and do not have the in-house expertise or time to engage in extensive market analysis, either to assess current trends or to find new markets. This may explain why 90 percent of the businesses with fewer than 20 employees do not anticipate any change in their customers in the next five years, while larger businesses expect more change. Analyzing potential markets, particularly in Pennsylvania and the Northeast, and providing this information to hardwood businesses would be a valuable service to the industry. This local market analysis and information would be of particular value as Pennsylvania producers have the location advantage of being close to large urban markets.

Market analysis should cover a range of products and encompass potential future foreign competitors.

Examine Pennsylvania’s investment assistance programs to determine if they are designed to meet the needs of the state’s hardwoods industry, including both small and large businesses.

Increasing efficiency and competing with producers of similar products were identified by surveyed businesses as key issues. A main way to become more efficient and competitive is to stay on the forefront of production

technology, which requires investment in new technology and equipment.

The recommended examination would include programs, such as the Machinery and Equipment Loan Fund (MELF), to determine whether they are reaching hardwood businesses and meeting their needs. Also to be determined is whether such programs reach the range, by size and type of product, of businesses and especially those in rural locations.

Devise a range of on-site workforce training and education programs.

The need for a trained, skilled and efficient workforce has been identified by previous research as a key for U.S. wood products firms to compete in the global and national economy (Sampson, 2003; Schuler and Buehlmann, 2003; Vlosky and Chance, 2003; Baumgardner, et al., 2004). Almost half of the Pennsylvania firms surveyed indicated that they had problems finding workers with the proper skills.

The survey for this project and the Vlosky and Chance study in Louisiana found similar training preferences by wood products firms, and both concluded that it will be difficult to devise and carry out workforce training programs. Three-quarters of the Pennsylvania firms surveyed preferred to do their training internally. Specifically, smaller firms cannot afford to have their employees absent from the production site to attend training. Given that the majority of hardwood businesses in Pennsylvania are small, if workforce training and education programs are to reach that segment, on-site programs will be necessary.

However, the types of skills that respondents indicated were lacking will make this a challenge to address. The three top skill needs were work ethic, basic schooling and technical skills. While the first two are very basic skills that are not commonly included in work force training programs, a program in Oregon included basic math, reading, and computer skills, as well as workplace readiness components such as operating procedure, basic communication skills, and good employee work habits (Leavengood, 1996).

Programs to upgrade technical skills will also be important. The survey results showed that, in the last five years, three-quarters of the firms had invested in new technology or equipment, and 61 percent indicated that retraining was required. Most of the needed retraining was in computer and software, and machine-specific skills.

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