

Labor Needs and Skills Assessment Report for Mississippi's Forest Products and Furniture Cluster

**A Report to the Mississippi Development Authority under sub-
contract to Mississippi State University**

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Chapter I

Introduction

The forest products and furniture industries have had a long and influential role in the development of Mississippi's educational system. The early agricultural high schools prepared youth for forest products and furniture occupations. The development of the state's furniture manufacturing cluster in the 1950s influenced the establishment of vocational education centers and, in the 1960s, a technical training center for manufacturing in Tupelo as part of Itawamba Junior College. Today this cluster is still a major employer, but is overshadowed by the employment needs of the service sector and newer, more technology-driven, faster-growing clusters. Yet the forest products and furniture cluster remains an important source of employment and business development.

While the use of wood as the basic ingredient forms the basis for this broad-based cluster, there are many features that distinguish the technology, labor, and skill requirements among the types of companies that work with wood as a primary input. The managers of large export-oriented manufacturers of upholstered furniture have little in common with the sawmill operators. The labor market needs of logging companies bear little resemblance to those of artisan woodworking firms or paper mills. Further, the skill requirements of the very large export-oriented furniture companies are quite different from the small furniture companies that may make custom products on demand. The skills needed by a competitive company in the wood/furniture cluster range from the most creative and highly honed skills used by companies crafting high-end, one-of-a-kind furniture to the most basic skills used in the more routine tasks associated with upholstering and assembling furniture.

Thus, to fully understand the employment, skill, and knowledge needs of all of Mississippi's forest products and furniture cluster, it is most useful to organize, describe, and analyze the cluster in terms of its sub-clusters: logging, wood, furniture, and paper. A study of the furniture industry in Appalachia in 1996, which began with the assumption that northeastern Mississippi and northwestern Alabama constituted a single "wood-based" cluster, concluded that the upholstered furniture manufacturers in northeastern Mississippi operated quite independently of the case goods manufacturers in nearby northwestern Alabama.¹

Any study of the workforce and the system that prepares and upgrades the labor force must also take into account the different ways in which work is organized and managed within the companies and within its own regional production system. The manufacture of large volumes of upholstered furniture is based on a mass production system that was originally designed for the manufacture of motor vehicles, and thus many of the skills are similar to those used in other advanced manufacturing clusters. A high-scale production of wood parts also requires many of the same skills as other manufacturing operations, such as CNC, CAD, and CAM. The production of customized furniture or

cabinetry requires more fine art skills and experience that develops over time. The skills are difficult to acquire in any short-term training, but can be enhanced with new techniques that may involve new types of finishes or tools. Size of company also makes a difference in skill requirements. Employees of smaller companies are expected to be more versatile and have a broader set of skills. Larger firms are more likely to provide career ladders, while smaller firms are more likely to lead to entrepreneurial opportunities.

This section of the report examines the current and projected employment needs, labor, markets, and occupational and skill needs of companies in the wood based cluster. It assesses the education and training programs that prepare the members of the workforce, improving their skills and their perceived value to the cluster. These institutions range from secondary vocational programs to post-baccalaureate programs. Most of Mississippi's technical and vocational education takes place in its vocational schools and 15 community colleges. Non-credit training is carried out mainly through the workforce centers at the community colleges, using both state workforce funds and federal Workforce Investment Act funds. Higher education occurs in the colleges and universities, with Mississippi State University, the state's land grant university, dominating the wood sectors. Finally, the report looks at attitudes toward the cluster within the system and the career opportunities available to students that take employment in the cluster. Throughout the analysis, the study distinguishes among the four sub-clusters that work with wood: logging, manufactured wood products, furniture, and paper.

This report is organized to present (a) the demand side (employees, skills, knowledge, and traits); (b) the supply side (employees, education, training, and related services); (c) opportunities (career paths and entrepreneurial); and (d) linkages between academia and the cluster.

Chapter II

Looking at Demand: Employer Needs and Skill Gaps

Estimates of future demand for both labor force and skills are taken from information provided by companies in surveys and focus groups, and from what was learned in other interviews with service providers educators, administrators, and support staff. Ordinarily, estimates of demand would also include the ten-year occupational demand projections based on data from the Bureau of Labor Statistics. Mississippi's occupational projection data, however, use baseline 1998 demand numbers that are significantly different from the employment numbers shown by other databases and used throughout this report,. Until this discrepancy can be resolved, we will analyze demand on the basis of our survey of Mississippi employers in the forest products cluster, using the national numbers given below as a baseline.

Table 1
Mississippi Employment in Wood Cluster Industries, 1998 - 2000

	Lumber and Wood Products	Furniture and Fixtures	Paper and Allied Products
1998	28,437	27,272	8,947
1999	26,100	30,556	8,708
2000	24,238	30,723	8,194

Source: Bureau of Labor Statistics, Covered Employment and Wages series

A. Mississippi employers' projected labor needs

The survey of companies provides current estimate of employment growth for the next year (Table 2). Furniture employers appear to be the most optimistic, with a quarter expecting to grow; logging employers seem the most pessimistic, with one in 20 expecting growth and one in five expecting decline. Paper industry employers expect employment levels to remain generally stable.

Table 2
Changes in employment projected for 2003

Cluster	Increase	Decrease	Stable
Logging	5.0	19.0	76.0
Wood Products	21.9	26.0	51.1
Furniture	25.8	8.0	66.2
Paper	7.5	5.0	88.5

Source: Survey of employers, 2002.

A small number of companies gave reasons for anticipated changes in employment. (Table 3). The most common reason for both increases and decreases, not

surprisingly, is changes in the market for the company's products. But some companies are benefiting while others are losing out. Automation is another, though less common, factor in expected employment reductions.

Table 3
Reasons given for changes in employment levels

Sub-cluster	Reasons for increases	Reasons for decreases
Logging	3 Market change	4 Market change 1 Automation 1 Lifestyle
Wood products	4 Market change	2 Market change 2 Automation 1 Low lumber supply
Furniture	7 Market change 2 New products	3 Market change 2 Import competition 1 Automation
Paper		1 Automation 1 Reduced capacity

Source: Survey of employers, 2002.

When asked what occupations the companies would be expecting to fill in the next year, employers emphasized jobs with relatively low educational requirements. Only five of 785 jobs specified information technology occupations and only four were engineers (all in paper). The largest proportions of expected demand by occupation for sub-clusters were as follows:

Wood products

76% of projected openings are for general unskilled labor (152 out of 198 total projected job openings in wood products firms)

17% of openings are for skilled production labor (33 out of 198 openings)

Furniture

51% of projected openings are for upholsterers (197 out of 388 projected openings in furniture firms)

7% of openings are for general unskilled labor (28 out of 388 openings)

Paper

40% of projected openings are for general unskilled labor (17 out of 43 projected openings in paper firms)

28% of openings are for telephone sales (12 out of 43 openings)

Logging

42% of the openings are for equipment operators (10 out of 24) and 21% (5 out of 25) are for logging companies.

Source: Survey of employers, 2002.

The distribution of employment across occupational categories is shown in Table 4. It shows the relatively small proportion of professional and skilled employment as compared to proportions of semi-skilled workers and laborers. More than half of those

employed in each of the sub-clusters are semi-skilled, laborers, or shipping/transport, all of which have low formal educational credential requirements. The numbers of IT specialists and sales staff in this cluster are particularly low.

Table 4
Distribution of Employment by Sub-cluster, by Occupational Group

Occupational Group	Lumber &	Furniture &	Paper &
	wood products	fixtures	allied products
	Percentage of Total Employment		
Managerial	4.0	3.0	4.7
Professionals, specialists, non-IT	1.8	1.2	2.9
IT specialists	0.1	0.2	0.8
Health and designers	0.1	0.2	0.7
Sales	0.9	0.7	1.4
Support staff	5.8	7.2	8.3
Building and facilities	1.0	0.8	0.3
Forestry, timber, and logging	12.2	0.0	0.3
Production supervisors	5.3	4.3	6.9
Skilled production workers	14.4	29.5	10.1
Semi-skilled production workers	28.0	43.6	39.4
Transport and shipping	10.1	2.6	11.5
Laborers	16.4	6.9	12.7

Source: Mississippi Employment Security Commission, 1998 data

B. Regional Variations in Demand

Mississippi's community college system is the state's primary delivery system for vocational and technical education for industry. Because colleges are limited, for the most part, to serving firms located within their prescribed district boundaries, it is useful to examine the distribution of companies among the districts. This is done by comparing both numbers of employees and the relative concentration of employment in the cluster as compared to relative employment nationwide, an index called a "location quotient." A value greater than 1.0 indicates a higher-than-average concentration of that industry in the area.

Table 5
Employment and Location Quotients by Community College District, 2000

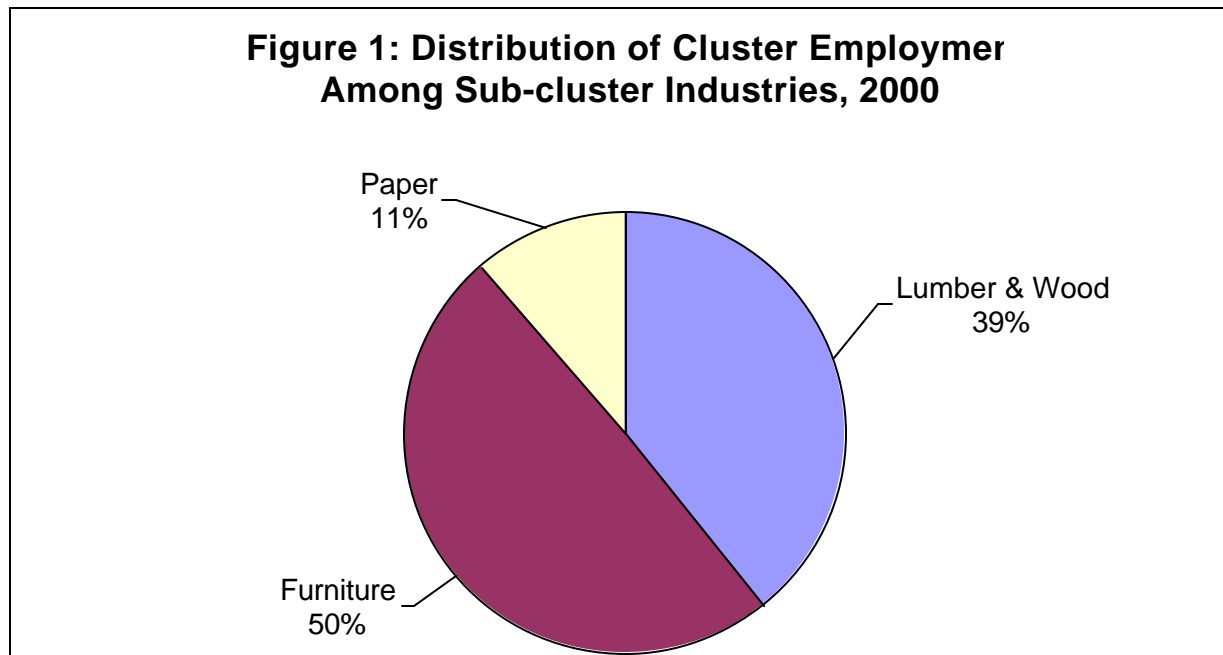
College District	Lumber & Wood	LQ	Furniture	LQ	Paper	LQ
Coahoma	226	3.73	13	0.33	3	0.06
Copiah-Lincoln	2,167	8.05	84	0.47	1,106	5.12
Delta	813	2.13	483	1.92	231	0.75
East Mississippi	1,928	5.98	862	4.06	1,303	5.03
East Central	1,776	6.37	1,057	5.77	36	0.16
Gulf Coast	1,001	1.10	195	0.33	99	0.14
Hinds	1,991	1.59	237	0.29	889	0.88
Holmes	2,186	5.53	708	2.72	731	2.30
Itawamba	1,452	2.42	17,562	44.57	1,129	2.35
Jones	4,083	13.02	22	0.11	680	2.70
Meridian	348	1.62	90	0.64	156	0.90
Northeast	1,597	5.49	6,397	33.44	144	0.62
Northwest	1,856	2.87	2,058	4.84	234	0.45
Pearl River	883	2.00	519	1.79	747	2.10
Southwest	1,992	14.84	0	0.0	130	1.21
Total	24,299		30,287		7,618	

Source: Mississippi state ES-202 data

Note: Sub-clusters defined by 2-digit SIC codes: SIC 24 (lumber and wood), SIC 25 (furniture and fixtures), and SIC 26 (paper and allied products).

As Table 5 indicates, the furniture sector is heavily concentrated in the northeastern part of the state, an area that is served by both Itawamba and Northeast Mississippi Community Colleges. Eighty-six percent of the jobs in furniture are in northern Mississippi. Paper is most heavily concentrated in the area served by East Mississippi and Copiah-Lincoln Community Colleges. Lumber and wood are most evenly distributed, with the largest relative concentrations in the area served by Jones County Junior College, Southwest, Copiah Lincoln, East Central, East Mississippi, Holmes, and Northeast Community Colleges. Every community college district in the state had a location quotient of greater than 1.0 for these sectors.

Figure 1 shows the distribution of the state's cluster employment among the sub-cluster industries. Furniture is the largest employer in the cluster, followed closely by lumber and wood. Paper accounts for only a small percentage of the state's forest products employment.



C. Mississippi employers' requirements for education, skills, and knowledge

What do the companies in the cluster need in terms of education, credentials, skills, and personal characteristics, and how important do they believe these are to their future competitiveness? We combined general industry knowledge with a detailed survey of Mississippi's forest product employers to learn about these requirements.

1. Impacts on competitiveness

More wood and paper companies viewed the quality of education as a negative factor than a positive one, while the logging and furniture companies took the opposite perspective (Table 6). One explanation may be that logging and furniture have more entry-level positions that require less education and therefore depend less on the school system, or it could be that the schools where these clusters are concentrated are indeed better. All sub-clusters viewed the community colleges as a very positive influence, even though most had little direct contact with the colleges. Despite the best efforts of the community colleges, the availability of both skilled and general technical labor was viewed more negatively than positively. The paper companies in particular were concerned about future availability. The acquisition of knowledge would increase competitiveness, all sub-clusters believe, although some, especially in paper and logging, believed it would be harmful.

Table 6
Percent of companies noting positive (+) and negative (-) impacts of selected factors on their future competitiveness, 2002

Factor	Wood		Furniture		Logging		Paper	
	+	-	+	-	+	-	+	-
Quality K-12 Education	18.5	27.9	29.7	21.6	21.4	14.3	0.0	46.7
Community college focus	23.3	5.0	35.2	2.7	32.1	5.4	6.7	20.0
Technical skilled labor availability	18.6	28.8	14.3	37.1	25.5	38.2	6.7	60.0
Knowledge acquisition	36.1	4.9	56.8	2.7	41.1	8.9	50.0	14.3
General labor availability	30.6	41.9	27.0	48.6	30.5	42.5	13.3	60.0

Source: Survey of employers, 2002.

Note: The remaining responses were either neutral or no opinion.

The managers of work force development centers at the community colleges were also asked to rank, on a scale of 1 (low) to 5 (high), how important these sub-clusters are to the future of their economy. The views of the eight respondents reflected the composition of their district's economy, with the Southwest rating furniture very low but the northern and eastern districts rating it 4 or higher. Wood products other than furniture were rated above average by all but one. Logging and sawmills were rated as unimportant in the northeast but above average in central and southern Mississippi districts.

2. Educational levels for new workers

The wood-based clusters currently employ people with relatively low levels of education, in stark contrast to the claims of most national industry leaders that most entry level manufacturing workers now need some post-secondary education (Table 7). More than 80 percent employed in all four of the wood-based clusters have no more than a high school education, and about a third of those working in wood and furniture have not even completed high school. Fewer than one in twelve employees in any of the sectors has a post-secondary degree. It does not appear that this is changing very quickly. While employers spoke of needed additional skills, there were very few suggestions that they wanted higher levels of education. Gaps occur in the management and professional positions of the larger employers, not among the general work force.

Table 7
Composition of work force by levels of education and credentials

Sub-cluster	Less than HS	HS or GED	Tech Diploma /Certif.	Military Tech School	Some college	Associate's Degree	Bachelor's Degree
Logging	26.5	56.5	2.6	1.6	6.4	1.1	3.5
Wood Prod	31.4	50.3	2.2	1.2	6.3	1.5	5.7
Furniture	27.4	56.7	2.8	0.2	7.3	0.8	4.8
Paper	13.4	61.7	2.4	1.8	13.8	1.6	5.4

Source: Survey of companies, 2002

In the focus groups, companies confirmed the low demand for formal education. Most said a high school education is required, and some claimed even that is unnecessary. A few asserted that they needed a community college degree or equivalent for certain skilled jobs—mainly in the wood products sector. Comments included (sub-cluster in parentheses):

- You've got to know how to read and write...at least high school or better. (logging)
- Schooling as far as high school. (logging)
- A twelfth grade education is good, but some of my best employees...probably haven't got four of five years of schooling. (logging)
- I'd say twelfth grade education, you know, someone with good common sense. (logging)
- You're not going to get a college student to grab hold of a chainsaw and go out there eight hours a day and run it. (lumber)
- A two-year degree wouldn't hurt...high school is fine though. (furniture)
- Our entry level is high school or below, and I'm glad that we're able to provide jobs for people who do not have high school educations. (furniture)
- We probably prefer them to have technical school rather than college. (wood)
- Ideally everybody would be a high school graduate. (wood)
- We don't care if it's high school or below if they can upholster. (furniture)
- Junior college, if they offer courses directly to the lumber industry. (wood)

3. Required skills for the new and incumbent workforce

Skills needs and priorities identified in the employer survey

The survey asked respondents to rate the importance of various kinds of skills, shown in Table 8. For all sub-clusters, teamwork skills outranked all others. Problem-solving skills was next for logging and wood, but furniture companies ranked communication second and paper companies ranked basic math second. The three highest-ranked skills for each sub-cluster are shown in bold.

Table 8
Percent of employers rating skill as very important

Skill	Logging	Wood	Furniture	Paper
Interpersonal teamwork skills	91.8	71.2	69.2	87.5
Computer skills	12.1	24.2	26.3	25.0
Problem solving skills	71.4	59.1	53.8	68.8
Tech. skills (other than comp.)	55.7	36.8	33.3	56.3
Basic math skills	35.6	38.2	56.4	75.0
Basic reading skills	41.2	44.8	61.5	62.5
Industry specific knowledge	62.1	34.8	47.4	50.0
Communication skills	72.1	56.7	66.7	56.3
Supervisory skills	49.2	53.0	50.0	43.8
International language skills	5.3	3.1	2.6	0.0

Source: Survey of companies, 2002.

Note: Top three in each sub-cluster are in **bold**

The focus groups revealed some even more basic employee requirements that had more to do with work ethic and work habits than skill or knowledge. A large number of the participating companies expressed concern about declining work habits and company loyalty among employees and were frustrated about having no way to change it. Comments included (sub-cluster in parentheses):

- We're finding bodies...not people that have the characteristics and the loyalty that we had in the past. (furniture)
- I would like to have, number one, employees who are motivated. (furniture)
- We're not finding people that are willing to work in our industry. (wood)
- There's no sense of pride in their work. (furniture)
- Loyalty is the problem. (furniture)
- Kids nowadays can't do anything. (logging)
- Young kids have no work ethic. (furniture)

This emphasis on work ethic is consistent with the findings of other studies conducted in Mississippi and elsewhere in the U.S. A number of wood companies also mentioned English language skills, though these ranked low in the survey. Many of these companies mentioned turning increasingly to Latino workers that have limited English ability.

Technical skills were not mentioned nearly as often as the softer work skills. This may be because the small and mid-sized enterprises (SMEs) in the wood cluster have been slow to automate. While the large companies, as well as some mid-sized companies, and many softwood sawmills have adopted CNC equipment for routing and metalworking and use automated cutting machines, many companies have been reluctant to make the investment in new technologies. For some SMEs these may be rational decisions, because it is difficult to use standard technologies efficiently and still meet the frequent style changes that customers demand. This is largely why low

enrollments have led to the abandonment of the automated furniture technology programs. The companies that have modernized can get skilled technicians from more generalized manufacturing programs and train them internally on their particular processes. Many managers even feel that, although an associate's degree may be preferable, they can take high school graduates and train them to use their automated technologies effectively. One industry expert in the furniture sector contends that "the culture of the industry is not ready for high technology." Many of these entrepreneurs started in garages with little technology and still believe they can compete by making knockoffs cheaper than their competitors.

The larger companies clearly do have requirements for technically proficient non-production employees for back office work, including computer support, business management, and marketing. These needs were not specified by those employers surveyed—perhaps because there is an adequate supply from non wood-specific programs.

Perhaps as important but less well known is that physical skill and endurance are requirements for many positions in the cluster. The stamina necessary to handle heavy equipment and move large pieces is part of many positions. According to one expert observer, "few upholsterers can handle the daily work routine past about age 35." The typical practice of paying group piecework incentives places strong peer pressures on each worker to meet what is sometimes a 150 percent work quota. This may limit the potential labor market for many core occupations to those with the requisite physical strength and endurance, and some may be forced out as they age.

Skills needs based on national profiles

Table 9 below gives an overview of some of the more common occupations in the wood products cluster and the skills, education, and experience required in order to perform these jobs. The information provided comes from the Occupational Information Network (<http://online.onetcenter.org>). As noted above, physical strength and stamina are a requirement for nearly every occupation in the cluster; it is not repeated in the table because it appears to be a given for these occupations. Other physical characteristics that are common to many of these occupations include manual and finger dexterity, quick reaction time, and control precision (the ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions).

Though there are several positions in which a two-year degree is applicable, hardly any occupations are listed as requiring this degree. This conforms to cluster employers' statements that most employees need only a high school degree, and that even supervisory roles are filled by promoting experienced workers from semi-skilled positions. The lack of requirement for post-secondary education seems problematic, however, given the medium- to higher-order skills required for some of the positions. Several of the cluster occupations call for information and data analysis skills, the ability to identify and assess problems (and probable solutions), communication skills, and knowledge of basic mathematical and mechanical skills. Some of these, of course,

might be learned in high school, gained through experience, or present simply due to innate ability; however, they are often associated with at least some post-secondary education. The low opinion that many employers have of the educational system may cause them to prefer to teach these abilities on the job, or to do without them, rather than trying to find them through formal educational channels.

The strongest similarity between the Mississippi employers' stated skills priorities and those presented in the national skills profiles is in the area of judgment and problem solution. Even the occupations that call for no higher education and little training make some mention of the need for skills in situation analysis, problem identification, or troubleshooting. The survey results show that in the logging, wood, and paper sub-clusters, problem solving was among the top three skills most frequently cited as "very important." One way in which the national skills profile differs from Mississippi employers' priorities, however, is in its emphasis on technical and physical skills, with relatively little mention of the interpersonal, teamwork, and communications skills that make a strong showing in the survey results. The national profiles sometimes mention communication skills for higher-level positions, and personnel management skills for supervisory positions, but do not at all stress teamwork or interpersonal skills for other occupations.

This difference may be due to a bias toward technical education on the part of the compilers of the profiles. It is likely also due, however, to the slow rate at which Mississippi cluster employers adopt new technologies, as discussed above, and to their tendency to prefer on-the-job training and lower levels of education. Operations in which employees are expected to learn from supervisors and from each other and while working require employees to be able to communicate well and effectively. It also may reflect the generally increasing need for soft skills among U.S. manufacturers.

Table 9
Forest Products and Furniture Cluster Occupations and Required Skills Base

Occupation	Education and Experience Needed	Personal/ Professional Skills and Knowledge	Technical Skills and Knowledge
First-line supervisors/ managers of logging workers	Can require two-year degree, but more often promoted from lower positions on basis of several years of on-the-job experience	Personnel and time management; work schedule development, planning and implementation; problem analysis and troubleshooting; communication	Equipment and machine selection and management; knowledge of production methods and processes; equipment inspection and monitoring
Log graders and scalers	High school diploma and a few months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Information gathering, judgment and analysis, physical strength and dexterity	Some knowledge of mathematics; product inspection skills; information processing and organization
Logging tractor operators	High school diploma (usually) and a few months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Teamwork skills, manual dexterity, multilimb coordination, trunk strength, control precision [~]	Equipment and control panel monitoring, general mechanical knowledge, equipment operation and control
Cabinetmakers and bench carpenters	Some post-secondary vocational training, often including associate's degree; one to two years of related hands-on experience and training	Manual dexterity and control, control precision, [~] visualization ⁺ skills, complex project design and implementation, information ordering [*]	Equipment operation and control; some knowledge of mathematics, design, building materials, and general mechanical principles
Furniture finishers	High school diploma and a few months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Problem identification and analysis, manual and finger dexterity, visual discrimination, creativity, independent project implementation	Equipment selection and control, product inspection, knowledge of building and design materials and methods
Model makers, wood	Bachelor's degree can be required, or associate's degree plus two to four years of related on-the-job experience; sometimes, short vocational training plus extensive experience is sufficient	Control precision [~] and coordination, visualization ⁺ skills, complex design skills, project analysis and implementation skills, problem analysis and troubleshooting	Knowledge of design principles and techniques, building and construction methods and materials, and general mechanical principles; ability to use blueprints and other schematic tools, select and control equipment

[~] The ability to quickly and repeatedly make precise adjustments in moving the controls of a machine or vehicle to exact positions

⁺ The ability to imagine how something will look after it is altered according to plan or when its parts are moved or rearranged

^{*} Indicates ability to follow and perform complex procedures, instructions, and operations in a necessary arranged order

Occupation	Education and Experience Needed	Personal/ Professional Skills and Knowledge	Technical Skills and Knowledge
Patternmakers, wood	Bachelor's degree can be required, or associate's degree plus two to four years of related on-the-job experience; in an employee with extensive experience, short-course vocational training may be sufficient	Control precision [~] and coordination, visualization ⁺ skills, problem and situation analysis and resolution, project planning and implementation	Knowledge of design principles and techniques, building and construction methods and materials, and general mechanical principles; ability to use blueprints and other schematic tools, select and control equipment, inspect and evaluate products
Upholsterers	Some post-secondary vocational training, often including associate's degree; one to two years of related hands-on experience and training	Visualization, manual and finger dexterity and strength, information ordering, visual discrimination, design creativity, project planning and implementation	Create and use design schematics, select and control equipment; knowledge of necessary materials and tools
Woodworking machine setters and set-up operators	High school diploma and a few months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Control precision, [~] visualization, ⁺ manual and finger dexterity, problem identification and analysis	General mechanical principles; installation, operation, control, and monitoring of equipment and systems; data and information analysis
Woodworking machine operators and tenders	High school diploma or equivalent usually required, with some on-the-job training	Manual and finger dexterity, control precision, [~] information ordering, visualization, ⁺ ability to follow complex instructions and procedures	Operation and monitoring of equipment; testing and maintenance of equipment
Sawing machine setters and set-up operators	High school diploma or equivalent required, with either some post-secondary vocational training or two-plus years of related on-the-job experience. Associate's degree may be applicable, but not often required.	Manual dexterity, control precision; [~] identifying, processing, and analyzing data and information; problem identification, analysis, and resolution	Selection, operation, monitoring, and control of equipment and machinery; product inspection; knowledge of mechanical principles and tools, mathematical basics, and production and processing materials and methods
Sawing machine operators and tenders	High school diploma and a few months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Manual dexterity, control precision, [~] information ordering, ⁺ problem identification, locating and using data and information	Selection, operation, monitoring and control of equipment and machinery; managing production processes and inputs; knowledge of mechanical principles and production methods

Occupation	Education and Experience Needed	Personal/ Professional Skills and Knowledge	Technical Skills and Knowledge
Paper goods machine setters, operators, and tenders	High school diploma and several months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Problem identification, control precision, ~ manual dexterity, locating and using data and information	Selection, operation, monitoring, maintenance, and control of equipment and machinery; managing production processes and inputs; knowledge of mechanical principles and production methods
Chemical equipment tenders	High school diploma and several months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Problem identification and troubleshooting, control precision, ~ quick reaction time, deductive reasoning, processing and analyzing data and information, communication skills	Operation, monitoring, and control of equipment systems and indicators; evaluating equipment indicator information against standards; documenting and interpreting information and data; knowledge of mechanical and chemical principles
Chemical equipment controllers and operators	High school diploma and several months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Information ordering, + control precision; ~ problem identification; ability to access, identify, and use relevant information	Operation, monitoring, and control of equipment and systems; product testing and inspection; basic mathematical facility and reasoning; knowledge of chemical and mechanical principles; interpreting and documenting information and data
Chemical plant and system operators	High school diploma and several months of on-the-job training; short vocational courses may be needed, but two-year degree not usually required	Problem identification and analysis, critical thinking, ability to access, identify, and use relevant information, control precision, ~ information ordering, + quick reaction time, project planning and implementation, communication	Controlling, inspecting, and monitoring machinery and equipment; monitoring processes and materials; knowledge of the principles of mechanics, mathematics, chemistry, and production and processing methods and materials

Source: Occupational Information Network (<http://online.onetcenter.org>).

It should be noted that this analysis is based on national occupational and skills profiles, so it should be applied with caution to the Mississippi forest products cluster. For example, the cluster employers' stated need for primarily high school graduates, with little emphasis on higher education, suggest that the educational requirements given here may be a level higher than those that would be required by Mississippi employers. The categories that this analysis describes as requiring some vocational training and possibly a two-year degree are more likely in Mississippi to require only a high school degree and perhaps some customized training courses as part of on-the-job training.

4. Training needs and priorities for the forest products and furniture workforce

Despite downplaying the need for education among their workforce, most cluster employers do acknowledge a need for more basic and soft skills and to upgrade selected technical skills. The highest rankings from the surveys for types of training varied somewhat among the sub-clusters.

- For logging, it was safety (83%), improved productivity (77%), and regulatory compliance (69%)
- For wood products, it was safety (87%), improved productivity (75%), and improved product quality (72%)
- For furniture, it was improved productivity (95%), improved product quality (92%), and safety, (68%)
- For paper, it was improved product quality (94%), improved productivity (82%), and build skills in new employees (81%).

When asked to rate the importance of various sources of training, it was clear that most companies rely most on internal sources and the companies that sell them their equipment or software.

Table 10
Percent of employers rating source of training as very important

Source	Logging	Wood	Furniture	Paper
In house/ on-the-job training	78.1	80.9	84.6	93.8
Equipment or software vendors	51.6	29.9	24.3	37.5
Vo-tech institutions	16.9	6.2	15.8	26.7
Community colleges	13.6	7.7	17.9	18.8
WIN Job Centers	5.5	3.3	0.0	0.0
Private firms & consultants	5.3	0.0	0.0	6.3
Extension services	19.0	1.6	5.4	0.0
Formal internal programs	19.6	21.9	31.6	50.0
University (excluding extension)	10.7	3.2	13.2	6.3

Source: Survey of employers, 2002.

Community colleges ranked above vocational-technical schools and universities in all sub-clusters except for wood (Table 10). It was interesting, however, that most of those interviewed still referred to community colleges as junior colleges, suggesting that they are not very close to the system and still view it as a transfer institution. In fact, many firms surveyed were not even aware that the Workforce Development Centers, located at Mississippi's 15 community colleges, offer federally funded training services. Almost half of the furniture and paper companies, more than half of the logging companies, and almost two-thirds of the wood companies were totally unaware of training opportunities at the work force development centers. When asked about the importance of these programs to their training needs, fifty-five percent of firms report that these programs or services are not important, and only about 20 percent state they are "somewhat" or "very" important. Furniture and paper companies put slightly more stock in these

programs than the loggers or wood products companies, perhaps because they tend to be larger and more apt to take advantage of government training resources.

The same lack of awareness applied to other government-sponsored workforce programs as well. At least half of the wood cluster companies were totally unaware of or unfamiliar with almost all sources of government funds for training (Table 11).

Table 11
Percent of Employers Not Aware of Various
Government Sources of Training Funds

Source	Logging	Wood	Furniture	Paper
Workforce Development Centers	57.9	65.2	45.0	43.8
Workforce Investment Network	53.6	69.7	50.0	50.0
Work Opportunity Tax Credits	50.0	59.7	52.5	50.0
NAFTA/Trade Adjustment	55.4	71.2	52.5	56.3
New hire/upgrade training	51.9	62.1	42.5	40.0

Source: Survey of employers, 2002.

As the survey results show, four-year universities are not generally thought of as significant sources of training for wood products-related industries. This may change in the next few years, however, at least for the furniture industry, with the development of the Franklin Center for Furniture Manufacturing and Management at Mississippi State University. This new center, on which construction began in May of 2002, will focus on research and development functions for the furniture industry, but will also serve workforce training and development functions. The center is scheduled to open in the fall of 2003.

In late 2001 the Community Development Foundation surveyed the furniture industry to identify its training needs. The highest advanced manufacturing skill was pneumatics, at 12th and then computer aided design, at 13th. Training in soft skills topped the list. The highest ranked needs were leadership/supervision (1st), teamwork (2nd), performance management (3rd), safety (4th), customer services (5th), problem solving (6th), spreadsheet use (7th), and advanced PC use (8th). The greatest need ranked by the number of employees to be trained were safety (1st), teamwork (2nd), problem solving (3rd), goal setting (4th), and basic math (5th). The top ranked manufacturing skill was computer numerically controlled equipment (12th). This confirmed a similar survey conducted in Louisiana for the TVA a year earlier. The most important knowledge, according to employers, was safety, with dealing with customers second and quality and process control third, and problem solving skills fourth. Skills for CNC or CAD ranked 40th.²

Chapter III

The Supply Side: Workforce Sources and Availability

Finding a qualified work force is a major problem for the majority of the forest products and furniture cluster. More than half of the respondents from wood products, furniture, and paper companies named general labor availability as a negative impact on their business success. Fifty-eight percent of paper companies, 42 percent of logging companies, and more than a third of both wood products and of paper named technical skilled labor availability as a negative impact on success. Much larger numbers named labor availability as very important to their future success.

The options available to companies for filling jobs include poaching from other companies, hiring displaced workers either from the industry or from others who have acquired the necessary skills, and recruiting students from the technical schools, community colleges, and universities. Companies can also hire unskilled workers, from the open labor market or from such services as employment security or WIA referrals, and teach them the basics of entry-level positions.

As described above, employers' major concern about the supply of workers was their difficulty in finding employees with a strong work ethic and who would develop loyalty to the company.

A. Sources of new employees

1. Entry level

All of the sub-cluster employers interviewed said that they draw their entry-level workers from within the local area. Loggers and saw mill managers emphasized that a desire to work outside and work hard were more important than educational background, although sawmill companies did cite a need for better basic math skills among workers. Most furniture makers want at least a GED or high school diploma and some said that a couple of technical courses at the community college were also desirable.

No firms interviewed mentioned special relationships with vocational secondary programs or community colleges as a way to find employees. In fact, the furniture companies expressed regret that Itawamba Community College's (ICC) two-year furniture degree has been discontinued. According to college sources, it suffered from low enrollments and is being re-tooled into an evening, part-time program with a broader manufacturing focus. The intent is to still serve employees in the furniture industry (as well as in other industries) who are working and cannot attend classes full-time during the day. The low enrollments in the full-time day furniture program at ICC, despite good career possibilities for its graduates, indicates a mismatch or misinformation between youth out of high school and the labor market.

2. Managers and professionals

Loggers and sawmill firms said they also typically rely on the local labor pool for supervisors and professionals because it is too hard to attract people to small towns in Mississippi. The salaries they pay for some positions, such as sales, are not as high as in other industries. Supervisors typically are promoted from within. Furniture manufacturers, on the other hand, advertise their management and professional jobs in national trade publications, but also face difficulty in attracting these employees because some candidates do not want to move to rural Mississippi.

The skills needed in the cluster are developed both formally and informally. Although much of what is needed in the industry is learned on the job, employers expect their new hires to have a certain minimum level of skills and knowledge of the industry. While they would prefer to hire someone who has worked in their industry, employers need a continuing flow of new entrants to replace those retiring or leaving the industry and to fill expanding occupations. As technologies and methods change, they also need employees with new skills.

B. Programs in educational institutions

The occupational programs that either target or meet the forest products and furniture clusters' needs are delivered through secondary vocational programs, community colleges, universities, and institutionally-based or -supported workforce development centers. Although there is some overlap in skill development, each fills a particular niche.

1. Technical secondary schools

Interviews with guidance counselors at traditional and vocational secondary schools in selected areas of Mississippi (chosen for their higher concentrations of cluster employment) indicated a fairly strong familiarity with the cluster and career opportunities but few substantial links with employers beyond presentations on career days. There are few specialized programs or industry-related extra-curricular clubs for the cluster within the secondary system, though forestry is somewhat of an exception through Future Farmers of America clubs that sometimes have a forestry bent.

Secondary level guidance counselors interviewed believe that students with a wide array of abilities can succeed in careers in the cluster, but most said that at least "average" capabilities are best, though low-performing students with "aspirations" can be successful. They pointed out that there is a broad range of occupations, from low-skill pulpwood workers to furniture factory owners, so the sector requires all types of educational levels.

Almost every guidance counselor interviewed said that they believe the wood products cluster is a viable career path for young people and they seem to recognize the importance of the industry to the state. However, counselors interviewed at traditional

high schools stated that few students come to them with an expressed interest in the field, which they attribute to the fact that most entrants already have a familial connection to the cluster and don't seek assistance from a guidance counselor. One counselor at a high school near Tupelo said "In the last nine years I think I have heard from one student who is interested in pursuing a career in one of these [wood products] industries."

The picture at the state's vocational technical schools that we interviewed was only slightly more encouraging. Counselors interviewed said that some students in the building trades program are interested in careers in the wood products industry. A few of these schools also have forestry programs, after the completion of which many students go into forestry programs at community colleges. Other than these forestry programs, there are only two other programs at the secondary level that are applicable to the forest products cluster: carpentry (which can also feed into building trades) and furniture making. Table 12 shows the location and 2002 enrollments in wood cluster-related secondary programs statewide.

Table 12
Enrollments in Wood Related Vocational Programs, 2002

District Name	College District	Description	Count
Choctaw County	Holmes	Forest Harvesting and Production	4
Enterprise (Jones)	Jones	Forest Harvesting and Production	11
Quitman County	Northwest/Coahoma	Forest Harvesting and Production	14
Covington County	Jones	Forest Harvesting and Production	19
Petal (Forest)	Pearl River	Forest Harvesting and Production	19
George County	Mississippi Gulf Coast	Forest Harvesting and Production	16
Greene County	Jones	Forest Harvesting and Production	16
Marion County	Pearl River	Forest Harvesting and Production	15
Perry County	Jones	Forest Harvesting and Production	12
Stone County	Mississippi Gulf Coast	Forest Harvesting and Production	15
Webster County	Holmes	Forest Harvesting and Production	21
Louisville Municipal (Winston)	East Central	Forest Harvesting and Production	10
Total: Forest Harvesting and Production Technology			172
Harrison County	Mississippi Gulf Coast	Carpentry	24
Hinds Community College (Hinds)	Hinds	Carpentry	16
Hinds Community College (Hinds)	Hinds	Carpentry	25
Jackson (Jackson)	Mississippi Gulf Coast	Carpentry	12
Moss Point (Jackson)	Mississippi Gulf Coast	Carpentry	20
Pascagoula (Jackson)	Mississippi Gulf Coast	Carpentry	13
Meridian (Lauderdale)	East MS/Meridian	Carpentry	10
Tupelo (Lee)	Itawamba	Carpentry	34
Leflore County	Mississippi Delta	Carpentry	17
Picayune (Pearl River)	Pearl River	Carpentry	26

Tate County	Northwest	Carpentry	18
Greenville (Washington)	Mississippi Delta	Carpentry	5
Total: Carpentry			220
Houston (Chickasaw)	Itawamba	Furniture Mfg & Upholstery	18
Okolona (Chickasaw)	Itawamba	Furniture Mfg & Upholstery	13
Pontotoc (Itawamba)	Itawamba	Furniture Mfg & Upholstery	13
South Tippah (Tippah)	Northeast	Furniture Mfg & Upholstery	15
Total: Furniture Mfg & Upholstery			59
Grand Total			451

As Table 12 shows, carpentry is the most highly populated wood products-related program in Mississippi's secondary schools; however, these programs feed into the craft and hobby aspects of carpentry as much as into the technical and professional applications (which, as noted above, could also include building professions). And while the forest harvesting and production program has enrolled 172 students statewide, this program tends to focus on the more "outdoor" aspects of forestry, rather than the value-added production side. Of these three programs, the only one that is directly targeting a wood products manufacturing industry is furniture manufacturing and upholstery, and it is the lowest-enrolling program of the three with only 59 students.

2. Mississippi's community colleges

Mississippi's community college system is the state's institution of choice for pre-baccalaureate technical and vocational education and for workforce education aimed at companies and individuals. The community colleges offer certificate and associate of applied science degrees in furniture manufacturing and both AAS and transfer-oriented associate of arts degrees in forestry. The workforce development centers at the colleges offer short courses and customized training. Further, the colleges are the primary providers of training programs offered through the Workforce Investment Act.

The vast majority of the education is aimed at the commodity manufacturing market, rather than at value-added manufacturing operations. The technical skills needed for manufacturing wood products—with the exception of Itawamba Community College's furniture program—must be acquired in the context of more generic manufacturing. Among the 15 Mississippi community colleges, eleven have forestry programs and one has a paper and chemical technician program. (See Appendix B for a description of these programs.)

Community college faculty in forestry programs reported that they recruit students through career days and through word of mouth. One college also uses television and newspaper advertisements. The paper and chemical technician program at Copiah Lincoln Community College, which is new and still in a pilot phase, recruits heavily, and seeks students with strong math and science skills. The forestry programs contend that they can accommodate students with a range in abilities from average to low

performing. They report that some students who did not perform well in high school can “find their niche” in forestry programs and succeed.

Forestry programs

Education for forestry, the common resource for the sub-clusters, is more popular with students and faculty than programs for the value-added manufacturing industries. Five colleges offer Forestry vocational or technical degree programs: East Mississippi, Holmes, Itawamba, Jones County, and Northeast. Nine colleges offer programs designed to transfer students in four-year programs—all aimed at forestry, not at value-added wood products.

Jones County Junior College (JCJC): Jones has a two-year forestry technology program that combines academic with hands-on education. Students learn about forest growth, harvesting, and protection but also math, botany, computers, and composition. This program attracts students from across the state and southern region. With 50 students enrolled this year, Jones’ program is the largest among the wood products-related community college programs; enrollment is down, however, from 100 students three years ago. Local sources attribute this decline to a slowdown in the industry.

The college also offers, for a small fee, short non-credit courses on topics such as the use of GPS/GIS software. Students are able to take a three-credit elective during the summer between their two years by working in industry and meeting certain learning objectives. The college uses social capital to build learning relationships and teamwork into the program. Students in the college’s forestry club use sports and social events to promote harmony and unity in the class. The college has a chartered student chapter of the Society of American Foresters that also meets with the local adult “Magnolia” chapter, which allows students to get to know potential future employers and vice versa.

Furniture program

The furniture industry, which is centered in the Tupelo area, has moved toward technology in order to compete with lower-cost nations. Technology began to penetrate the industry slowly, a step at a time, in material cutting processes, material handling, inventory, and bar coding. In the late 1980s, a group of industry leaders traveled to Texas to observe Gerber’s automated fabric cutting and moving equipment. In 1989, as a result, Itawamba Community College established the nation’s only technology center for upholstered furniture, and began offering the Furniture Manufacturing Technology Associate’s of Applied Science Degree and certificate programs. The center was opened with support from the Appalachian Regional Commission, Tennessee Valley Authority Gerber, and the state. Computerized equipment included the following Gerber tools: a design, merchandising and style development center; a design, grading, and marking work station; a fabric spreader; a cutting table; and an eight-unit material mover.

Only the larger companies adopted the new upholstery technology, however, and some of the mid-sized companies began to use CNC routers and new laminating technologies. The demand for higher-level manufacturing skills was constant but low. Acme, one of the region’s most automated and modern plants, has an array of CNC routers, band saws, and Gerber cutters. It was the first area company to install automated moving equipment in the sewing department. The company relies extensively on Itawamba for the skilled workers to operate these machines. A large number of its employees are graduates of Itawamba Community College’s certificate and associate’s degree programs, and many are sent back to acquire skills and credentials in order to get promotions. Acme has found that it is able to hire graduates of the associate degree program to become analysts and take on tasks previously done by industrial engineers, such as time studies, materials management, and supervision. Further, the company encourages its suppliers to work with the college and “likes for [their technical staff] to be trained at the college.”

But just as often, engineers in the work force are employed as efficiency experts, looking for ways to improve on the production cycle. Manual labor still dominates most of the work in furniture upholstery and it requires minimal skills. The low demand for advanced technical skills and the diminishing image of manufacturing as a career path forced the college to work harder and harder to recruit students—especially with the restrictions on state reimbursements for part time and evening students. Fifty students were enrolled in 1997, but the number dropped to only about 10 last year. As a result, in 2002 the college proposed a restructuring of the program with a more general advanced manufacturing focus and evening classes. The college also offers associate’s degrees in Electronics Technology, Robotics/Automated Systems, Tool & Die Making, Drafting and Design Technology. The proposed Center is waiting for a decision.

Table 13
Vocational/Technical Enrollments by College, Fall 2001

College	Program	F-T	P-T	Total
Copiah-Lincoln	Wood Science & Technology	9	1	10
Holmes	Forest Harvesting	19	1	20
Itawamba	Forest Harvesting	30	5	35
Itawamba	Furniture Manufacturing	1	9	10
Jones	Forest Harvesting	35	5	40
Northeast	Forest harvesting	15	0	15

Note: Only 5 colleges recorded vocational or technical enrollments in wood-based programs in fall 2001.
Source: Mississippi Vocational/Technical Enrollment by District, Fall, 2001.

Table 14
Graduates from Wood Related Programs at Community Colleges, 2001

District	Forest Harvesting	General Forestry	Wood Science	Total
Copiah-Lincoln	0	0	4	4
East Central	0	1	0	1
East MS	4	0	0	4
Hinds	0	1	0	1
Holmes	3	0	0	3
Itawamba	3	0	0	3
MS Delta	0	4	0	4
MS Gulf Coast	0	4	0	4
Northeast MS	2	0	0	2
Northwest MS	0	2	0	2
System	12	12	4	30

Source: State Department of Education data.

Clearly, the flow of graduates from Mississippi's cluster-specific community college programs will not be a significant source of skilled employees (Table 14) for the forest products cluster (though graduates from other industrial programs may be hired by some cluster employers). Since most employers stated that a high school education (or even less) is all that is required to fill most positions, however, the low numbers of enrollments and completions from these programs should not be a significant bottleneck in filling positions in these industries.

3. Universities

Mississippi's universities are not a significant source of employees for the wood products industries, because so few of the positions in these industries call for four-year or master's degrees. Supervisory positions tend to be filled from within the company. There are only a few programs in Mississippi's four-year schools that relate directly to the wood products industry, and one of them (general forestry) tends to feed into the timber harvesting industry rather than into value-added processing industries. There are also a few programs which, though not directly targeted at wood products-related careers, do give graduates skills that can be put to use in these industries. These are more heavily populated than the wood products-specific programs, but these graduates have many industries from which to choose. Table 15 below shows the number of 2002 graduates from both the targeted and the more general programs.

Table 15
2002 Graduates from Cluster-Related Programs in
Mississippi Universities

Program	No. of Graduates
General Forestry	40
Wood Science and Pulp/Paper Technology	8
Industrial/Manufacturing Engineering	27
Industrial/Manufacturing Technology/Technician	150
Industrial Production Technologies/Technicians, Other	20

Source: Mississippi Institutions of Higher Learning data.

C. Sources of training and workforce development

1. Workforce Development Centers

Each of Mississippi's 15 community colleges has a Workforce Development Center assigned responsibility for both responding to industry training needs and raising the skill levels of the state's incumbent workers, unemployed, and underemployed, in order to meet the needs of a modern industrial economy. The Centers were created in 1994 through legislation that moved the state's community colleges closer to supporting regional economic development. In 1999, the workforce development conducted through the technical schools was transferred to the Centers and merged with the community college-based programs.

Customized training in both job specific skills, soft skills, and basic skills for local businesses is the primary focus of the Workforce Development Centers. This training is provided through Center staff who write training projects based on requests from local firms, submit the projects to the State for funding approval, and provide varying levels of oversight for the implementation of the training projects. This is a source of training in the soft skills that companies say they want. (However, while skills such as teamwork and communications can be honed through short-term training programs, achieving proficiency in such skills requires an early and long-term educational investment.) A recent assessment of the Centers conducted by RTS found that across the state, most participating employers are generally satisfied with the services provided by the Centers and economic developers tout their capabilities when recruiting industry. A lack of marketing dollars has limited the Centers' impact in some areas. Workforce Investment Act funds are in theory also available, few have been used for training that can be traced to employment in the cluster.

While the majority of the industry training supported by the Centers is short-duration safety and non-technical classes, the Centers do also support high-level technical training that could be used in the manufacture of wood and furniture, shown in Table 16 below. But, based on a survey of a small sample of contracts, the vast majority of these are trained for other manufacturing clusters, such as the state's auto suppliers and other metalworking companies. The Centers are also capable of providing soft skills training,

such as programs in communication, supervision, leadership, and teamwork, which the cluster employers stated was a high priority.

Table 16
Workforce Development Center Training, FY 2001

Type of Training	Total # of Trainees	Total Cost of Training
Electronics	743	\$83,200
Hydraulics/Pneumatics	285	\$77,600
Industrial Maintenance	2,744	\$1,151,000
Industrial Production	50,112	\$2,076,800
Instrumentation	222	\$15,200
Quality Control Management	9,506	\$128,700

Source: Workforce Accountability Summary Report, FY '01 Annual Report, State Board for Community and Junior Colleges

In 2001 the state's Workforce Development Centers enrolled almost 150,000 people in 23,000 classes at a cost of \$10.4 million state dollars. Eighty-three percent of the training occurred at a company (often taught by firm trainers whose costs were reimbursed) and 17 percent at the college or a mobile site. The bulk of the training is industry-specific education, which includes industry/technical, service occupations, pre-employment training, supervisory courses, and soft and basic skills training (Table 15).

A key recommendation in the 2002 assessment of the state's workforce development system is that each Workforce Development Center become a lead center for surveying a particular industry cluster's needs, developing new curricula, staying in touch with cluster councils, updating skill standards, benchmarking practices in other places, and generally collecting information about cluster occupations and programs.

Cluster-specific training

In 2001, the state delivered 23,214 classes to 290,897 trainees (duplicated headcount). Of these there were:

- 810 classes with 8,959 students in furniture production and
- 17 classes for 221 students in forestry/lumber.

Given the low level of awareness of public sector support for training (see Tables 8 and 9 above), it is not surprising that very little use has been made of the state work force development funds available through contracts with the community colleges. Based on survey returns from eight of the state's 15 centers, 96 percent of all those trained in the cluster were in the furniture industry in northeast Mississippi. Fifty-two training contracts were approved at the eight colleges last year, 39 of them in furniture. The vast majority of training was in safety, not skill upgrading.

2. Workforce Investment Network Job Centers

Through the Workforce Investment Board, which provides federal funding that is administered through Workforce Investment Network Job Centers located throughout the state, Mississippi has provided cluster-specific training for 12 people to date: six in carpentry/cabinet making, four in forestry or forestry technology, and one as a millwright. These Centers also offer federally funded on-the-job training programs, which to date appear not to have been utilized by cluster employers.

3. Other sources of training

In addition, other organizations such as Tupelo's Community Development Foundation (CDF) are active in training. The CDF, partnering with Mississippi's Manufacturing Extension Partnership and Itawamba Community College, has offered six lean manufacturing workshops that included nine furniture companies and their suppliers. It intends to continue with this, assuming the MMEP receives continuing support. The CDF also has arranged a number of IT training programs that attract managers and employees from across the wood/furniture cluster.

D. Training networks

There was no evidence of firms being intentionally aggregated to form skills alliances or training networks. Although a cost-efficient way to provide training to smaller companies, this is not a common practice among Mississippi companies or work force development centers.

Chapter IV

Opportunities: Career Paths in the Cluster

Youth entering occupational programs today are influenced by where their initial jobs can lead. They want opportunities to advance to justify their investments in time and resources. They particularly want to know whether they have a future in “blue collar” occupations in manufacturing, which they know are declining in comparison to “white collar” service occupations. This section examines the career possibilities in the wood and furniture cluster.

A. Information about and access to jobs and advancement

Career paths for workers in the wood products cluster vary by sub-cluster, but share some common elements. Most of the firm owners and managers, guidance counselors, and community college instructors interviewed for this project stressed the importance of local connections to the cluster and family history of employment in wood-related firms as the most likely reasons a young person seeks a job or career in the cluster. First-year students in the forestry programs at Jones County Junior College meet each Monday with former graduates who are working in the field to learn about how their careers have progressed and where the opportunities lie. Many of the graduates have moved into management positions with their employers and have taken on high levels of financial responsibility in the company. A few have left to start their own firms to become owners, but the entrepreneurial path is less common than moving up within a large firm.

The counselors in the high schools, who often influence students’ career choices, are not very familiar with either post-secondary education or career opportunities in the cluster. Of the 16 high school counselors interviewed—half in the northeast region where the furniture industry is very strong—only five claimed to be very familiar with the career opportunities. Six were somewhat familiar and five were not familiar with the field. Based on other questions, what familiarity they did have tended to be more with forestry careers and manufacturing careers.

Workforce Center directors were also asked to rate on a scale of low (1) to high (5) career advancement opportunities for the various clusters in their districts. The respondents were generally optimistic about career advancements in furniture, with three of five rating it four or five and one rating it three. Logging and sawmills was mixed, with two districts viewing very good paths but the other four seeing few opportunities.

1. Entering the workforce

Community college faculty interviewed uniformly report great career potential for forestry and chemical [paper] technician graduates, both in the workforce and for

continuing their education. “Everything is wide open! Students can do what they want,” one interviewee said. Much less information is available to students about career paths in the furniture and wood production careers, although for furniture, which is more highly concentrated, students are more likely to be aware of management and ownership opportunities simply by knowing people who have moved up in those directions. The lack of information about careers is also due to the paucity of any specific educational programs designed to lead to employment in those industries.

After graduating from a two-year forestry program, about one third transfer to Mississippi State’s forestry program, while the remaining students enter the workforce as forestry technicians. Most go into the private sector, and some—a declining number as positions have been cut back—go to work for the federal or state government. Faculty interviewed report that most forestry students stay in the field and tend to “job hop” over their first few years to find the best fit for their interests and career plans.

Many of Copiah Lincoln’s paper and chemical technician graduates go to work for the company where they interned as a student, and large employers such as Georgia Pacific encourage their employees to continue their education after they have started working. Though the program is only two years old, many graduates work locally for large corporations. Starting salaries for graduates are about \$40,000 a year. The program is struggling for enrollments, however, apparently due to the difficulty of collaborating with local paper companies in order to populate the program.

2. Institutional support

The forestry and chemical technician programs have strong support from their institutions, according to faculty. One Jones Junior College faculty member said his college even sent him to Sweden twice to study their forestry methods. For the most part, the forestry programs report that they are in a stable position in terms of students and support from the college. “The career paths are there and they are secure and our program is doing well.” Copiah Lincoln’s chemical technician program, given its newness, is less stable and seeks more resources to recruit students. “This program and the paper industry is out there in need of eligible students and employees...[yet] we struggle with getting students with solid math and science backgrounds,” a faculty member said.

3. Opportunities for minorities and women

The vast majority of students in forestry programs are white males. The paper and chemical technician program at Copiah Lincoln is split evenly between men and women and about 20 percent of current students (2 out of 10) are African American. One of the forestry programs has a 2 + 2 partnership with Colorado State University for women and minorities, but its enrollments still only include 10 percent women and about 15 percent minorities. JCJC has an active recruitment program for minorities and this year about one in ten are minority. The college’s articulation agreement with Colorado State is

aimed at finding minority students who want to continue their education, and a few have transferred to that university.

B. Entrepreneurial opportunities

There is little evidence of entrepreneurial education in the cluster save what is fundamental to any forestry programs that are part of agricultural education. Most programs are based on finding employment for completers, not on self-employment. These programs may include modules or courses that teach business skills or economics, but they do not prepare for ownership.

Interestingly, many workforce development center directors rated entrepreneurial opportunities high in some of the clusters, especially among furniture and furniture suppliers in the northeast. The Pearl River area rated entrepreneurial opportunities very high for the logging and sawmill sub-cluster, while in the northern districts—where there is less logging and fewer sawmills—these opportunities were naturally rated very low.

Chapter V

Industry-Academia Linkages

The employers surveyed noted a number of relationships with colleges and universities that included but went well beyond training. Furniture and paper work with community colleges in training; furniture companies, in particular, also work with universities in solving production and other problems and in research and development. Yet overall, the vast majority of employers do not consider the institutions of higher education to be very important to their competitiveness (see responses in Table 17).

A. Firms' involvement with educational institutions

It is difficult to draw conclusions from the company survey about firms' involvement with educational institutions because only about one-quarter of those completing the survey responded to the question pertaining to this matter. It is impossible to know if those who did not respond do not take part in any activities or if they were somehow confused by the question. Of those who did respond, the most prevalent activity with schools that firms report is student internships (about half report hosting interns) and tech prep (again almost half report involvement). These are followed by career fairs (44 percent), and serving on industry advisory committees (38 percent). Very few companies report business assistance from schools or colleges, with the exception being loggers, half of whom report seeking assistance from universities or the K-12 system. About a quarter of firms responding to this question state they seek R&D assistance from universities, a percentage that is fairly consistent across sub-clusters.

B. Educational institutions' contributions to firms' competitiveness

The most robust data (75 percent valid responses) is available concerning forest and wood product firms' estimations of the contributions that educational institutions have for their competitiveness. Companies report, not surprisingly, that their closest ties to universities and community colleges relate to the training services that they offer. Still, when asked about external training relationships that contribute to business competitiveness, 43 percent of all respondents state that they do not have any, implying they rely solely on internal training resources (such as on-the-job training). This is particularly the case for loggers (57 percent) and wood products firms (49 percent), and somewhat less true for furniture companies and the paper industry (30 and 21 percent, respectively).

Of those remaining 57 percent of firms that do report training relationships outside of their companies, these relationships are equally likely to be with community colleges or vendors (28 percent and 27 percent respectively). Universities follow with 19 percent reporting these types of relationships. Looking at the numbers by type of firms, paper and furniture companies report the greatest number of training links with community

colleges (57 and 39 percent) while loggers report the most training with universities (24 percent). The latter likely reflects Mississippi State's extension activities.

The survey finds few other relationships between firms and educational institutions that businesses feel impact the companies' competitiveness. Fewer than 20 percent of firms report any relationships with colleges or universities in the areas of marketing, problem solving, or resource sharing. When asked about production methods relationships, however, 26 percent of furniture companies cite relationships with universities. A similar percentage of firms in the cluster report research and development relationships with universities, a number that holds true in each of the sub-clusters (Table 17).

Table 17
Percent of companies with positive responses concerning educational institutions' contributions to their competitiveness

Relationship	Universities	Community Colleges
With production methods		
Logging	4.2	0.0
Wood products	13.5	10.8
Furniture	22.2	7.4
Paper	0.0	0.0
With problem solving		
Logging	4.5	0.0
Wood products	8.0	8.0
Furniture	19.4	3.2
Paper	0.0	8.3
With resource sharing		
Logging	0.0	0.0
Wood products	3.7	0.0
Furniture	7.7	3.8
Paper	0.0	0.0
With marketing		
Logging	0.0	5.9
Wood products	4.0	4.0
Furniture	4.2	4.2
Paper	11.1	0.0
With training		
Logging	21.1	5.3
Wood products	26.9	19.2
Furniture	20.8	41.7
Paper	10.0	70.0
With R&D		
Logging	21.1	5.3
Wood products	34.8	4.3
Furniture	17.4	8.7
Paper	0.0	0.0

Source: Survey of employers, 2002

The survey also asks firms what past impact various factors had in their success (Table 18). One factor is the quality of K-12 education, and responses vary significantly between negative impact, “no,” “positive impact” and “don’t know.” The greatest response, with 36 percent, is “no impact.” Only 23 percent report a positive impact. Within the cluster, paper companies are most concerned about the quality of schools, followed by wood products and furniture companies, while loggers appear least concerned with only 14 percent reporting a negative impact.

Table 18
Employers’ estimates of past impact of quality of K-12 education on business success over the past two years, percents

	Negative	None	Positive	Don’t know
Wood Products	28	36	18	18
Furniture	22	38	30	11
Logging	14	34	30	21
Paper	47	40	0	13
TOTAL	34	36	23	17

Source: Survey of employers, 2002

Community colleges receive more positive responses from survey respondents concerning their impact on business success over the previous two years. Twenty-eight percent of all firms report they had a positive impact, while only 5 percent report a negative impact. Still, almost half of all respondents report no impact, and almost 20 percent state they “don’t know.” Furniture companies have the highest regard for community colleges. Paper companies appear to have the lowest regard, likely reflecting that there is only one paper and chemical technician education program in the state. Table 19 shows the responses.

Table 19
Employers’ estimates of past impact of community college on business success over the past two years, percent

Sub-cluster	Negative	None	Positive	Don’t know
Wood Products	5	50	23	22
Furniture	3	54	35	8
Logging	5	41	32	21
Paper	7	40	20	33
Total	5	47	29	20

Source: Survey of employers, 2002

When asked about the importance of K-12 and community college education to firms’ future business success, survey respondents rate both highly. Fifty eight percent report that K-12 education is “very” important and 44 percent say the same for community college education. Another 21 percent rated K-12 education as “somewhat” important to their future and 26 percent rate the focus of community college education as

“somewhat” important. These responses (Table 20) are fairly consistent across the sub-clusters, with paper companies expressing the highest importance due to its need for advanced science and math skills.

Table 20
Percentage of firms rating K-12 and community college education as “somewhat” or “very” important to their future business success

Sub-cluster	K-12	Community Colleges
Wood products	71	60
Furniture	86	74
Logging	80	73
Paper	92	91
TOTAL	79	70

Source: Survey of employers, 2002

Chapter VI Findings

In general, the emphasis on education and training for this cluster within the state is disproportionate to the contribution the cluster makes to the Mississippi economy. This is not unusual in the U.S. Many states with large forest products and furniture clusters offer very few education and training programs. In most states, wood and furniture are viewed as “traditional” industries and in some stage of decline relative to other industries. They are, therefore, of less interest to investors, policy makers, and career seekers. Yet we believe that regions of the U.S., including Mississippi, can compete in this field with sufficient innovation and creativity, and that it can remain a viable career option for youth and economic opportunity for the state.

While firms do not express a need for many skilled workers with two-year degrees or more (with the exception of the paper industry), they do want better basic math and in some cases technical skills. Most current skills development is done in-house; most employers do not use and have few links with educational institutions, whether at the K-12, the community college, or the university level.

Following are some of our key findings about the demand for labor and skills, the supply of education and training, career interests of youth, and linkages between employers and educational institutions.

A. Labor Markets and Employer Requirements

- **The furniture sector accounts for nearly half of all the employment in the cluster.**

Of the 62,204 jobs in the forest products and furniture cluster in 2000, 30,287 of them were in the furniture sector. Nearly 24,000 of these were located in the northeast region of the state.

- **Most companies do not use very high levels of technology and therefore do not require many highly technically trained employees.**

Except for the large furniture and paper companies and softwood sawmills, this cluster has been slow to automate. Many of the companies produce small quantities of customized products that do not easily lend themselves to automation or cannot be cost justified. Strength and dexterity are still important employee traits.

- **Formal educational requirements for most positions are low.**

About four of every five workers have no more than a high school education, and fewer than one in twelve has an associate's or higher degree. The greatest projected demand among employers is for semi-skilled and low-skilled workers. Yet more than half of the wood products and furniture companies perceive the availability of technical skilled labor as very important to their future.

- **The cluster currently has a sufficient number of entry level, low- and semi-skilled job applicants.**

Employers have enough new applicants for the low- and semi-skilled positions that dominate the cluster to meet the needs of expansion and replacement. The furniture segment of the cluster, in particular, is quite competitive and it experiences a great deal of job churning as employees "job hop" to seek higher wages. Even for those positions, however, many employees lack key qualifications, including strong English and basic math skills, and require investments in training. The smaller the firm, the more it must rely on external and state sources of training, yet the less likely it is to be aware of or to use available resources.

- **Most companies view the limited availability of both general and technically skilled labor as a threat to their future competitiveness.**

Even those companies not currently facing shortages are concerned about the future as they see interest in careers in their firms declining. They express concern about both the general work force and, as they consider modernizing, the more technically qualified work force. Professional and management support is also a problem, which owners attribute to a poor state image that can make attracting outside employees difficult.

- **Most firms cite improvement in productivity as their top reason to engage in training.**

While employers are not looking for a large number of workers with post-secondary degrees, they do still want better basic skills and recognize that training leads to improved processes and a better competitive position. Among the manufacturing firms in particular, there is an awareness that the future does not lie with low-technology processes.

- **The highest priority education and training needs among businesses are soft skills such as communication and teamwork.**

Improvement in soft skills is frequently the top specific training need expressed by companies in any cluster. Firms need employees who can better communicate, solve problems, and work in teams. These skills, identified more than a decade ago by the U.S. Secretary [of Labor] Commission on Achieving Necessary Skills ("SCANS Skills")

are now part of most educational outcome measures and skill standards, and more educational institutions are attempting to integrate them into all programs.

- **Declining work ethic among youth is a problem for firms.**

Many companies mentioned poor work ethic and lack of company loyalty, mainly among youth, as a growing problem. This concern has been expressed by managers in many clusters across the state and is not unique to the wood and furniture cluster (nor to Mississippi). It is perceived as a major problem to which no good solution has been found. But since these traits are transmitted by family, community, media, and culture, the educational system can only assume a small part of the responsibility. The most effective answer might be making career paths and routes to upward mobility more obvious so that employees can see future rewards for loyalty and dependability.

B. Supply of Education and Training

- **Companies have little familiarity with public sector training and sources of support.**

Only about one in eight companies views community colleges or universities as "very important" sources of training. Many of the companies were unfamiliar with the colleges and programs offered, frequently referring to community colleges as junior colleges, their former name. The response "not important" was given by about two of every five for community colleges and by three in five for universities.

- **Mississippi's educational system offers few programs that target the cluster.**

Despite the scale of this cluster in Mississippi, there are very few secondary (vocational-technical) or post-secondary educational programs at the community colleges for this cluster. Nearly all wood-related programs are about the preservation and stewardship of the forestland, not value-added uses of wood. Enrollments in the advanced upholstered furniture technology center at Itawamba Community College have fallen so far that the center will likely be revamped into a more general manufacturing technology center. It should be noted that many of the highest skill levels are associated with other programs such as engineering technicians and engineers, business, and marketing, and some of those enrolled in these more generic programs may be taking electives that give them specific knowledge of the cluster.

- **State-supported workforce programs for existing workers are very limited and, for the most part, involve short-term training in safety.**

Most firms rely solely on in-house or on-the-job training for new employees and skill upgrading. There are very few contracts under the state-supported training program for this cluster, perhaps because the demand is lower or because community college workforce development center staff have fewer connections to the many small firms in

the industry. The contracts that do exist are mainly for large furniture companies and their suppliers, who are big consumers of training. The vast majority of the cluster employees who do take part in state-supported training learn safety practices, not new production techniques, quality control or other subjects that would improve productivity or efficiency.

- **The pilot paper and chemical technician program at Copiah-Lincoln Community College is a good potential model of an industry-college partnership.**

Although still quite new and small, the program is closely tied to local paper companies and is creating a pipeline of skilled technicians. Demand from employers for graduates is high and entry-level jobs are high paying; however, the college must work hard to find interested, qualified students, and there is still work to be done in forging the most effective relationship between the college and local industry in order to populate the program.

C. Career Paths

- **Interest in careers in all of the sub-clusters among school youth is low.**

Overall, secondary school counselors generally are not very familiar with the careers in the industry, though they realize that the cluster is large in size and is important to the state. Youth have a significant amount of information about and access to programs in forestry. These secondary programs and extra-curricular organization, most of which are taught under the umbrella of agricultural education, are quite popular among students. The concentration of furniture companies in northeastern Mississippi leads to greater awareness among both students and school counselors of career possibilities and paths in the furniture industry, though this information mostly takes place through informal word of mouth, not through the educational system.

- **The educational system rarely initiates or promotes career paths for the cluster.**

Entry into wood-related jobs is mostly based on familial connections to the cluster. Career paths are not based on a smooth transition from secondary or post-secondary programs, because employees in the wood cluster generally have little formal education beyond high school, and in logging and wood products many employees did not complete high school. By acquiring on-the-job skills and tacit knowledge, and by demonstrating loyalty, some workers can move into supervisory positions. Other advancements—particularly salary increases—are made by “job churning,” or changing employers. Some employees have based their futures on taking an entrepreneurial track, many with success. There are many economic opportunities for innovators and risk takers that require relatively low investment. The exception to the above is forestry. There are adequate numbers of both secondary and post-secondary forestry programs

with established and smooth paths for progression in the field from the secondary level through community colleges and Mississippi State.

D. Linkages between companies and educational institutions

- **Firms infrequently look to educational institutions as sources of expertise that contribute to their competitiveness.**

Few companies report any relationships with colleges or universities in the areas of marketing, problem solving or resource sharing. One in four furniture companies does obtain production methods assistance from universities, and a similar number of companies across the cluster look to universities, primarily Mississippi State, for research & development assistance.

Chapter VII

Benchmark Education and Training for the Wood/Furniture Industry

A number of colleges around the world have established special programs or centers specifically to support the wood and/or furniture industries (Table 21). This section reviews some of the highlights of those programs. It includes colleges in North Carolina, which has the nation's largest furniture cluster; the Upper Peninsula of Michigan, a region heavily dominated by wood industries; a National Science Foundation-supported program in a forested region of Massachusetts; a college in Ireland tasked with reviving an ailing furniture cluster; the nation's only sawmill operator program, in the Appalachian region of North Carolina; and a college in Minnesota that focuses on wood and furniture finishing skills.

**Table 21
Benchmark Programs at Community Colleges**

<i>College</i>	<i>Form</i>	<i>Location</i>	<i>Specialty</i>	<i>Students</i>	<i>Programs</i>	<i>Strengths</i>	<i>Support</i>
Galway-Mayo Institute of technology	Furniture College	Letterfrack, Ireland	Design	140	Certificate, BS	Co-located Furniture Technology Center, art/design focus	System Tuition
Catawba Valley Community College	Furniture Division	Hickory, North Carolina	Production	70	AAS	Industry support, Industry involvement	Industry State Tuition
Mount Wachusett Community College	Forest and Wood Products Institute	Wachusett, Massachusetts	Biomass energy Marketing	25	Concentration in Mfg AAS	Links to industry Cooperative programs with <i>Wood Digest</i>	NSF grant State
Haywood Community College	Program	Waynesville, North Carolina	Sawmill operators	15	Certificate	Leads to management, draws nationwide	Tuition
Finlandia College	Programs	Marquette, Michigan	Furniture	N/A	AAS, BS	Link to Finnish design college	National foundations Tuition
Dakota County Technical College	Programs	Rosemount, Minnesota	Wood finishing & restoration	18	Diploma Certificate	Smithsonian Inst. Endorsement, connection	College foundation, Tuition

A. Reviving Ireland's Furniture Cluster: The Furniture College at Letterfrack

Ireland's system of 14 institutes of technology (which are roughly equivalent to U.S. community colleges, although they also offer some applied baccalaureate degrees) established a special college for the furniture industry. The college is a satellite campus of Galway-Mayo Institute of Technology, located in the village of Letterfrack in a poor, rural part of Connemara in western Ireland. The college is self-contained and offers full programs, although there is some shared staff with the main campus in Galway and opportunities for students to take courses offered in Galway.

Ireland's furniture sector, though an important part of the domestic economy because it is mostly locally owned in an economy heavily dominated by foreign-owned branch plant, was not globally competitive. It contributed little if at all to Ireland's recent economic renaissance. The cluster embodied almost no spirit of cooperation and had been slow to modernize. The cluster is made up mostly of small companies that produce for domestic consumption and were not noted for aesthetics and design. Few employ professional designers. Most companies are owned by entrepreneurs with some manufacturing but little management or marketing expertise. Yet Ireland believed that the cluster had the potential to reinvent itself around the artistic and innovative talents of its youth.

The solution to the cluster's woes was placed on the shoulders of education and training—of both workers and management. The recent assessment of the furniture industry confirmed that its training deficiencies hold at all levels from operatives to managers. “In production/technical areas, workers with detailed understanding of the properties of materials used and their reactions to each other, tools, machinery, safety, etc., are just not available to employers.”³

In 1988 Connemara West Centre, a community development organization in the village of Letterfrack, with the Galway-Mayo Institute of Technology (GMIT), embarked on a project to infuse the industry with skilled and talented workers and creative design, and the region with sustainable jobs and development. Together they established a Furniture College to teach youth about design and modern manufacturing in order to grow and strengthen the Irish furniture industry. Its stated goals were to:

- provide for the local community, region, and nation a base for the development of the Irish Furniture industry,
- enable graduates to contribute to and influence the design process and manufacture of modern furniture in ways that are innovative, creative and responsive to social and economic need,
- provide the seed ground for the development of an indigenous approach to furniture making and enhance the influence of Irish design, and

- create market awareness of quality furniture made in Ireland.

GMIT rented facilities from Connemara West and developed and certified the education programs. The partners agreed to develop and deliver a two-year, third level program in Furniture Design and Manufacture, and establish Letterfrack as a national source of workers skilled in modern furniture design and technology. The college has grown substantially since 1990, when the first national certificates were conferred, and since 1992, when the college received 380 applications for just 15 places. By 1997, the program enrolled 27 students and offered 2 certificate programs (1 in furniture design and manufacture and 1 in furniture production), as well as a baccalaureate program in furniture technology. By 2000, the college had 85 students, and in 2002, enrollment is projected to reach 160. Applicants to the certificate programs must have a good grasp of math and science plus, preferably, previous work in sciences, computing, engineering, technical drawing, and art.

Since the program emphasizes entrepreneurship and design, students are expected not only to understand furniture materials and processes but also how to manage an enterprise and sell its goods. Besides wood, students are encouraged to creatively incorporate copper, steel, plastics, and fabrics in their furniture design. They also learn to apply computer-based technologies necessary to their craft to achieve high-volume production.

The program's entrepreneurial spirit has yielded results. Since 1990, graduates have successfully started 15 new businesses in Ireland that incorporate design and innovation into high-quality and artfully crafted products. By integrating management, marketing, and administrative skills with technical and design skills, the Furniture College enhances its graduates' entrepreneurial capabilities.

As the college developed, it added a research and development institute, and more directly diffused the technologies being taught to its students into the industry. This solidified Letterfrack's claim as the furniture skills and technology center of Ireland. In 1997, a Furniture Technology Center was established at the college funded by Forbairt, Ireland's Science and Technology agency. In 1999, the Furniture Restoration Center opened, also as a separate legal entity from the college, and college students are now engaged in restoration work for the National Gallery of Ireland.

The Furniture College and Technology Center and its skilled workers and artisans are changing industry attributes and attitudes. Ireland's furniture industry is beginning to show a new appreciation for the value of training, information systems, and professional management among employers and an emerging willingness to share information and cooperate. The overwhelming entrepreneurial aspirations of students are slowly helping to grow the cluster.

The effects on the local economy thus far are attributable mainly to the college itself, not the students or technologies it produces. In the last two years, a number of staff members have located to the area, a trend likely to continue as Letterfrack's infrastructure and services improve to meet the needs of the new arrivals. There is now

regularly scheduled bus service to Galway, and housing has been renovated and amenities expanded to accommodate the growing student body and faculty. Construction on the college in the last two years (some \$4.4 million) employs local contractors and brings other workers into the area, generating additional economic activity. Student involvement enriches the local community, and college facilities (e.g., library, evening classes, and sports facilities) are available to the community. Student housing and other facilities serve a growing tourist trade in the college's off-season.

B. Forest and Wood Products Institute at Mount Wachusett Community College, Massachusetts

The Forest and Wood Products Institute was established at Mount Wachusett Community College, in Gardner, Massachusetts in 1996. It was created to train workers for primary and secondary wood products industries and to assist industry in maintaining, expanding, and marketing forest and wood products. Its mission includes skill development, demonstration, and business assistance and its service area is the entire state. Although the wood manufacturing industry is spread across central and western Massachusetts, much of the logging and sawmill activity is in and near Gardner, a city of about 20,000 in the north central part of the state.

The Institute is governed by an 18-member advisory board, which meets quarterly. The Board helps the Institute coordinate its efforts with other industry, state and federal programs. The Institute was founded as a result of a needs assessment of the industry that showed a sizable demand for higher skill levels. An entrepreneurial faculty member, Nick Weidhaas, applied for and received a grant in 1998 from the National Science Foundation's Advanced Technology Program to establish the Institute. He had considerable support from industry as well as from the U.S. Forest Service, the Wood Products Manufacturers Association, and various other national manufacturers associations.

The Institute does not offer any specific degree programs, but it does offer six courses in wood manufacturing that constitute a Wood Products concentration within the college's AAS in Manufacturing Technology. The program is new and the expected enrollment this year is 20-30. Since it is offered at night, most of the students are mature adults already in the labor force. The college is also offering its first web-based credit course—in wood structure and properties—and has a new NSF/ATE grant to further develop its web based programs. The courses are offered cooperatively with the *Wood Digest*, a partnership that helps to market the courses nationwide.

The college also offers certificate programs such as Sustainable Forestry Initiative (SFI) Logger certification program, which requires 32 hours of continuing education credit that must be completed within a 24-month period, and a wide range of workshops. The workshops, in topics such as GPS systems, logger education, managing solid waste, finishing, and lean manufacturing attract people from the entire northeastern United States. The web program includes non-credit certificate programs in generic

management areas such as goal setting, communications, employee motivation, and manufacturing efficiency.

The Institute coordinates its activities with a number of public agencies and private associations. It has, for example, close ties to the Woodworking Digest and it has worked with the Massachusetts Manufacturing Extension Partnership. Since part of the Institute's mission is strengthening the industry and its markets, the college hosts a Wood in Transportation program to promote the use of wood in transportation structures, bridges, guard rails, etc. It has a Biomass Energy program to support the use of biomass energy.

The staff is optimistic about the future of the Institute, although it has not really proven itself yet. It has industry support but it is not yet clear what value the industry places on AAS manufacturing degrees. The real demand may come from employees who want to accumulate credits toward a bachelor's degree. The companies are, however, making good use of the continuing education and workshops offered by the college and it is becoming established in the industry.

C. Furniture Production Technology at Catawba Valley Community College (Hickory, North Carolina)

The heart of the furniture cluster in Hickory, North Carolina is the Furniture Technology Division at Catawba Valley Community College (CVCC). Much of the Hickory furniture industry has embraced the technological revolution and has begun modernizing their operations. In so doing, the industry depends heavily on the college. The Furniture Technology Division was one of the original departments of the community college, which was founded in 1960. Thirty years ago furniture had already become the major industry of the Hickory region, having grown from more humble beginnings at the turn of the century. In the 1970s the college constructed its own working furniture factory, allowing students hands-on experience in the furniture-making process from wood drying all the way to the finished product. While the Division does offer some courses for the woodworking craftsman, the main emphasis is on factory production. Over time, the Technology Division acquired more and more specialized equipment. Today, the Division has state-of-the-art production machinery, capable of taking CAD-produced designs and reproducing them with a precision measured in the 1,000s of an inch. Students work as much with computer terminals and digitizers as with saws and lathes. Despite being housed in a rural North Carolina community college, the Division could not be more technology-intensive.

The driving force in today's furniture industry is the need to please the most demanding home furnishing customers. Consumers want customized designs and fabrics, quick delivery times, impeccable quality and low cost. One way of addressing these demands is for firms to become marketing platforms and serve as a conduit of lower-priced imported furniture. Since its inception in 1960, Catawba Valley Community College has

played a major role in supporting the recruitment and expansion of furniture industries in the region.

The college grants two-year associate's degrees in furniture production technology and offers a concentration in design and product development. Short-term diploma and one-year certificate programs are offered in upholstery, cutting and sewing, and furniture production. Currently, there are roughly 70 students enrolled in furniture programs at the college. About 50 of these are in the one-year certificate programs in upholstery and cutting/sewing, while about 20 are enrolled in two-year associate's degree programs. The two-year associate's of applied science programs require up to 76 total credit hours and are structured to enable students gain valuable on-the-job experience by working in the industry part-time while enrolled. Students typically attend classes for 25 hours per week and work for 20 to 25 hours per week on average.

Students completing the two-year production technology program are prepared for jobs in engineering, management, CNC programming, manufacturing operations, and production control. Students in the design and development concentration are qualified to work in various jobs involving the design and development of furniture products. These students can also continue their design education by enrolling in a four-year degree program at the Kendall School of Fine Arts and Design.

The Furniture Technology Division serves the specific needs of industry by providing customized training on request. Faculty can develop specialized training in the following areas:

- Basic and advanced CNC programming
- Basic and advanced sewing machine repair
- Basic and advanced touch up and repair
- Basic AutoCAD
- Basic solid modeling

The number of graduates has dropped by 50 percent due to industry downsizing. However, endowments and scholarship funds remain strong, which reflects the continued strong support of local industry. The Furniture Technology Division has an active industry advisory board that meets on a bi-monthly basis.

D. Business-Based Finnish Design at Finlandia University

Many rural areas find that the best way to create higher-wage jobs is to cultivate entrepreneurs. Having people with the knowledge and ambition to start their own companies in their own hometowns is often more effective than recruiting outside firms. Finlandia University, located on the northern tip of Michigan's Upper Peninsula, is engaging in such an approach by infusing business and entrepreneurial education into its art and design curriculum. The college turned to Finland, a country with which the region has strong cultural ties, for inspiration and assistance in adapting contemporary

Finnish business and educational practices. The resulting program, Business-Based Finnish Design, provides students with an education in both design and business.

Originally Suomi College, a two-year institution offering certificates and associates' degrees, Finlandia University has recently expanded its facilities and become a four-year university. The only private, higher educational institution in the Upper Peninsula, Finlandia is a small school that draws most of its students from the area and maintains close ties with the region's leaders and businesses. Atypical of small, private schools, Finlandia sees a strong role for itself in regional economic development and knows the importance of working with employers. Comparing the school with larger public universities, one businessman said that Finlandia is "more willing to work with local industry on product applications." The college now offers two- and four-year degree programs.

In the mid-1990's, the college's administration, searching for ways to promote entrepreneurship among its students (and thus in the region's economy), asked its departments of art and design and business administration to explore ways to link their curricula. For assistance, administrators turned to Finnish design schools and eventually formed a partnership with the Kuopio Academy of Crafts and Design in Finland. The resulting program, Business-Based Finnish Design, provides students with an education both in design and in business/entrepreneurial practices, giving them the business acumen and design skills to succeed as employees and as independent businesspeople.

In addition to their design and business classes, students work on projects for private firms in the region. This work is more than a simple internship; it is integrated into the curriculum, and the students get direction and advice from both their private industry mentors and their teachers. More connected to the real world than simply working on a class assignment, students gain work experience at the same time they are receiving a practical education. Examples of these student projects span the spectrum of industrial design. Students worked with Strandwood Molding, Inc. to develop prototypes for products and tooling and a promotional video. Horner Flooring used Finlandia students to design a transport dolly, and the Nitrate Elimination Company used them to design product packaging. This hands-on aspect of Finlandia's program not only provides experience to students, but also effectively provides technical assistance to companies by giving them access to design expertise (both students and faculty). This sort of product design/development skill is hard to find in most rural economies.

Most U.S. design schools educate students with the expectation that they will join large companies. Finlandia's program, however, prepares students for work in a rural environment where they are more likely to be hired by a small company that requires its employees to have a broad range of skills and to do more than execute their design abilities.

The program graduated its first students in April 2000. With the majority of students coming from the region, it is hoped that the graduates will help develop the region's

economy by remaining and working for local companies or starting their own. The full impact on long-term business creation and development, however, will take years to materialize. Still, judging by the number and quality of student projects of the class of 2000, the program is off to a propitious start.

E. Wood Finishing: Dakota County Technical College

The Wood Finishing Technology Program at Dakota County Technical College in Rosemount, Minnesota, was established in 1973 and is the *only certified Wood Finishing Technology Program in the U.S.* Graduates work as wood finishers, furniture restorers, spot repair artists, and pre-finishers. In the past, graduates of the program did not have any problems finding employment. The job placement rate has been up to 100 percent. To assist the students in their job search, the college's placement office maintains a library of employers. A number of graduates have started their own successful wood finishing or repair businesses.

The program offers a diploma in wood finishing technology that can be earned in nine months of study for a total of 36 credits and a furniture service technician certificate that can be earned with a total of 19 credits. Current total enrollment is 18 students, an increase from the average of 12 students in the recent past. While the focus is on wood finishing, the program also teaches skills needed for upholstery, leather, and vinyl repair. In addition, the program offers a number of summer workshops and customized training for the industry. The program recruits students as part of college-wide recruitment and information activities in high schools.

Summer workshops are weeklong intensive courses for small groups (maximum class size is 18) with an emphasis on hands-on learning experience. Topics include finishing new wood, furniture refinishing, restoration and conservation, advanced finishing workshop, technology and preservation of coatings, and preservation of polychrome furniture. Some of the workshops are offered in partnership with the Smithsonian Center for Materials Research and Education as part of a long-term collaboration in furniture preservation technology education. All summer workshops are open to "anybody who enjoys the beauty of wood." No specific experience or skill levels are required.

The program has a 13-member advisory board, which includes technicians and leaders from different segments of the industry. These experts provide current and accurate information from the industry so that "the students are informed and ready for what is happening in the wood furnishing world" when they graduate. The advisory board's main function is to assist the program in its efforts to maintain a high level of expertise and accurate information.

The Dakota County Technical College Foundation provides financial assistance not only to students, but also to individual programs. In addition to financial contributions, college supporters also donate supplies, tools, and equipment to the programs. The

program is endorsed by the Smithsonian Center, through which some of the courses are offered.

Chapter VIII

Recommendations

The following recommendations are intended to make the educational system more responsive to the needs of firms in the cluster and to stimulate cluster competitiveness.

Recommendation 1: Establish lead community colleges as “hubs” for each sub-cluster, with links to universities.

Community colleges are dispersed across the state and are the logical purveyors of technical and soft skills education for firms that need skill upgrading and other assistance. Following the recommendation of the recent report to the SBCJC, we recommend that certain community colleges—to be selected by the state or through competitive bids—take the lead responsibility for each of the four sub-clusters: logging, wood products, furniture and paper. Lead responsibility means going beyond developing and offering new curricula. It means establishing and maintaining intensive connections with the industry, assessing needs, developing marketing and educational materials for secondary schools, monitoring technological development, updating curricula, and, to the extent needed, developing skill standards.

Lead colleges would also formally and informally share their information and materials with other community colleges in the system. The Alabama Technology Network uses this approach in its manufacturing extension services. This approach would require some modest levels of funding above and beyond FTE reimbursements, and requires close cooperation between the vocational-technical division and the workforce development center at each institution since both should be heavily involved.

Links with appropriate departments at universities should be forged so that there is a smooth conduit for firms to receive production and research and development assistance that community colleges cannot easily provide.

Action: Select two colleges as Centers for the furniture cluster—one to concentrate on production and productivity and one to focus on design for aesthetics and quality. Establish another center for the wood products cluster, one for logging, and one for the paper and pulp industries.

Itawamba Community College has had such a furniture center since the 1980s, but in the past couple of years employers' utilization has diminished—in part because employees cannot easily attend courses organized in the traditional model of semester-long daytime courses. This Center is still the natural location for furniture production after restructuring its programs to meet the needs of working and mature students. Its current efforts to embed the furniture skills into a more generic advanced manufacturing program environment dovetails nicely with the recommendation that cluster-based

concentrations, not entire programs, are appropriate (Recommendation 2). Copenhag-Lincoln Community College is a good choice for the paper industry cluster hub since it has the state's only two-year paper and chemical technician program. Benchmarks that might be used to develop a Center with design capabilities include Finlandia in Marquette, Michigan and the Furniture College in Letterfrack, Ireland, which requires each applicant to present a portfolio demonstrating artistic/design talent.

The lead faculty member at each Cluster Center should be given sufficient release time to carry out the non-teaching responsibilities mentioned above. Ideally, the "director" would establish inter-institutional teams to conduct much of the work. He or she would also be responsible for dissemination of new information and knowledge.

Recommendation 2: Rather than creating specific new programs for the cluster, establish concentrations in existing technical and business programs that offer cluster specific courses.

It appears unlikely that the systems can support full-scale programs for the cluster since the skill requirements differ by sub-cluster. Instead, we recommend establishing minors or concentrations for the cluster in various existing programs—both at the community college and university level. This would allow the student to acquire a more general credential but also some cluster specific knowledge. We recommend concentrations within existing manufacturing/industrial programs, business technology programs and in design programs.

Actions: SBCJC and the universities should delegate responsibility to specific faculty teams to design concentrations within existing programs, either by offering new electives or teaching existing courses in the context of the wood and furniture industries.

Recommendation 3: Introduce web and lab specialty courses, such as product design, finishing, and restoration, for niche companies.

There are many special niches within the cluster that have market potential but too little demand at most institutions to justify a program. These include product design, finishing, and restoration of antiques and historical buildings. Some of this could be taught using web-based courses supplemented by labs and/or apprenticeships. Because these skills require hands-on experience, the theory must be accompanied by shop work or apprenticeship positions in companies with master crafters.

Actions: The system should review existing curricula and practices and determine what can be adapted in Mississippi. For example, the Forest and Wood Products Institute at Mount Wachusett Community College in Massachusetts is working to create a number of wood-related courses on the web and is a potential partner. The state's SBCJC already has an online community college that is a potential vehicle for web-based course work. Dakota County Technical College in Minnesota has a recognized wood

product finishing program that works with the Smithsonian Institution. Aldini-Valeriani Technical Institute in Bologna, Italy has a world-class restoration program.

Recommendation 4: Better inform and educate youth, counselors, and employment services of employment and career opportunities.

In the Tupelo area, nearly everyone has a friend or relative, or acquaintance connected to the furniture cluster. Word of mouth suffices for spreading information about jobs and careers. But in most parts of the state, economic prospects in the cluster are not as well known to youth, high school staff, or the public. Careers in wood are not encouraged as a career path and programs are not taken by very many youth, largely because the cluster is not supported by the programs within the schools and because much of the cluster is located in rural communities. The most educated youth seek the high tech careers they read about that will take them to large cities and that offer rapid growth possibilities. Wood and lumber is where their grandfathers worked.

Action: The challenge is to find ways to make the jobs in the cluster exciting, which requires either promoting high levels of technology or creative design and innovation. The Mississippi Development Authority should work with a marketing firm to find ways to re-define the cluster and to work with educational institutions to better showcase their wood-related programs, particularly once some of the new education and training elements recommended here are available. Materials should include brochures for guidance counselors, presentations for career days, and a mobile exhibit that can be taken to middle and high schools. Efforts should focus as early as middle school, since evidence shows that many students are “turned off” from many industries before they begin high school.

Recommendation 5: Prepare community college-based Workforce Development Centers to meet the cluster’s training needs and increase marketing to cluster employers.

Since most employers in the cluster place a low value on post-secondary credentials, the Workforce Development Centers at community colleges, working with Workforce Investment Boards, which are charged with skill upgrading of existing workers, are perhaps better positioned to provide the short-term soft skills and technical training that firms require.

The low levels of awareness among employers of state and federally supported education and training resources, including the Workforce Centers, are due in part to weak marketing. The Workforce Centers, however, currently lack the resources to aggressively market their programs to the small firms in the cluster. This was a recommendation in the recent report to Mississippi’s State Board of Community and Junior Colleges (SBCJC) and Workforce Investment Board.⁴ A more comprehensive marketing system might increase utilization of the available resources within the cluster.

In addition to marketing, however, Workforce Center staff should become more familiar with the cluster's needs so that even the "soft skills" can be taught in the context of the industries. They could gain this expertise through the cluster "hubs" described in Recommendation 1.

Action: The most effective means of marketing the workforce development system is through organizations that have regular contact with the most employers. This is made difficult by the large number of small employers and, in at least two of the sub-clusters, lack of associations with local chapters or that provide real services. MDA should organize employers and work with the SBCJC and WIB to develop a marketing plan for the Workforce Centers.

Recommendation 6: Create a formal alliance among Mississippi's Institutions of Higher Learning, the Manufacturing Extension Partnership, and Mississippi State University Extension Services to use a more skilled work force to accelerate modernization efforts.

The low level of technology adoption is a threat to the competitiveness of the industry. The original impetus for a national manufacturing extension service (the Manufacturing Extension Partnership) was the modernization of small and mid-sized enterprises (SMEs), which requires concurrent new skill development. More than a decade ago the Southern Growth Policies Board published "The Education of the Renaissance Technician,"⁵ in which it urged the Southern region to upgrade the skills of its workforce so that it could become a catalyst for new production methods. It is important that the state's modernization efforts are coordinated and synchronized with the institutions that know the SMEs and that do the education and training, which in some instances might then become the catalysts for change. Some of Mississippi's training in lean manufacturing is already being carried out through such partnerships, but the scale of activity is low.

Action: The community colleges and universities should make a concerted effort to assess the potential for modernization in those companies with growth potential and work together to help them make the transition. Teams of extension engineers and college staff could make site visits together, as they do in Alabama and Wisconsin.

Recommendation 7: Develop programs for the logging and wood industries in the secondary schools using the educational philosophy of agricultural education.

Since many of the entry-level jobs in the cluster do not require post-secondary education, the most effective way to prepare a workforce is a solid secondary education in which academic skills and "soft" skills are integrated with vocational competencies and knowledge of the industry. The most successful model, arguably, is what was once

called vocational agriculture. It remains more closely aligned with academic programs, includes “all aspects of the industry,” retains links to industry leadership, and has solid leadership training via FFA.

Actions: For the two sub-clusters in which there is minimal division of labor (logging and wood), we suggest developing a secondary track to parallel the existing more common “forestry” programs and that uses the logging and wood clusters as their context for teaching academic and vocational education. It should include cooperative education or apprenticeships with firms in the cluster.

Recommendation 8: Expand entrepreneurial education and training for the cluster.

This cluster developed to its current position through its spirit of entrepreneurship. Acme Furniture, for example, one of the largest employers, was started by someone who once was an employee at Futorian. Its employees have, in turn, started eight new companies. Loggers and sawmillers also have a rich history of entrepreneurship. It is important to continue to promote that spirit, by taking advantage of the entrepreneurial philosophy of agricultural education, the Entrepreneurship Initiative at the Appalachian Regional Commission, and the programs and resources of the Kauffman Foundation. The Furniture College in Ireland is a benchmark that has been successful in achieving new business startups.

Actions: Review for possible adaptation in Mississippi existing successful practices such as:

- REAL Enterprises, in which students develop and operate businesses (available both at high school and community college levels)
- Community colleges initiative of the Kaufmann Foundation
- Those funded through the newly founded National Association for Community College Entrepreneurship.

Appendix A

Classification of Occupations

Management

Financial Managers
Personnel, Training & Labor Relations
Managers
Purchasing Managers
Marketing/Advertising/Public Relations
Managers
Administrative Managers
Engineering, Mathematical & Natural
Sciences Managers
Industrial Production Managers
General Managers & Top Executives
All Other Managers & Administrators

Professionals and specialists, Non-IT

Accountants & Auditors
Buyers, Farm Products
Purchasing Agents
Personnel, Training & Labor Relations
Specialists
Cost Estimators
All Other Management Support
Industrial Engineers, Except Safety
All Other Engineers
Electrical/Electronic Technicians &
Technologists
Drafters
Foresters & Conservation Scientists

IT specialists

Data Base Administrators
Computer Support Specialists
Computer Programmers

Health

All Other Health Professionals,
Paraprofessionals/Technicians
All Other Professional,
Paraprofessional/Technicians

Sales

First Line Supervisors, Sales & Related
Salespersons, Scientific Products &
Services
Salespersons, Except Scientific & Retail
All Other Sales & Related

Support staff

First Line Supervisors, Clerical &
Administrative
Secretaries, Except Legal & Medical
Receptionists & Information Clerks
Personnel Clerks, Except Payroll &
Timekeeping
Order Clerks, Materials, Merchandise &
Service
Bookkeeping, Accounting & Auditing Clerks
Payroll & Timekeeping Clerks
Billing, Cost & Rate Clerks
General Office Clerks
Computer Operators, Except Peripheral
Equipment
Switchboard Operators
Production, Planning & Expediting Clerks
Weighers, Measurers, Checkers &
Samplers, Recordkeeping
All Other Material Recording, Scheduling &
Distributing
All Other Clerical & Administrative Support

Building & facilities

Guards & Watch Guards
Janitors & Cleaners
All Other Cleaning & Building Service
Workers

Forestry, timber, logging

First Line Supervisors,
Agricultural/Forestry/Fishing
Fallers & Buckers
Log Handling Equipment Operators
Logging Tractor Operators
All Other Timber Cutting & Related Logging
Workers
Log Graders & Scalers

Production supervision

First Line Supervisors,
Mechanics/Installers/Repairers
First Line Supervisors, Production &
Operating

First Line Supervisors, Transport/Moving
Machines
First Line Supervisors,
Helpers/Laborers/Movers-Hand
All Other First Line Supervisors,
Product/Construct/Maintain
Precision Inspectors, Testers & Graders

Skilled production

Production Inspectors,
Test/Grade/Sort/Sample/Weigh
Machinery Maintenance Mechanics
Millwrights
Machinery Maintenance Workers
Maintenance Repairers, General Utility
Automotive Mechanics
Bus & Truck Mechanics & Diesel Engine
Specialists
Mobile Heavy Equipment Mechanics,
Except Engines
All Other Mechanics, Installers & Repairers
Carpenters
Electricians
Painters & Paperhangers, Construction &
Maintenance
Plumbers, Pipefitters & Steamfitters
Machinists
Tool Grinders, Filers & Sharpeners
All Other Precision Metal Workers
Pattern & Model Makers
Wood Machinists
Cabinetmakers & Bench Carpenters
All Other Precision Woodworkers

Semi-skilled production

Drilling/Boring Machine Tool Setters,
Metal/Plastic
Machine Forming Operators
Welding Machine Operators
All Other Machine Setters, Metal/Plastic
All Other Machine Operators, Metal/Plastic
Sawing Machine Setters
Head Sawyers

Sawing Machine Operators
Woodworking Machine Setters
Woodworking Machine Operators, Except
Sawing
Furnace, Kiln, Oven, Drier, Or Kettle
Operators
Boiler Operators, Low Pressure
Cutting & Slicing Machine Setters
Cutting & Slicing Machine Operators
Coating, Painting & Spraying Machine
Operators
Cementing & Gluing Machine Operators
Packaging & Filling Machine Operators
All Other Machine Setters & Set-Up
Operators
All Other Machine Operators & Tenders
Welders & Cutters
Grinding & Polishing Workers, Hand
Assemblers/Fabricators Except
Machine/Electronic/Precision
All Other Hand Workers

Transportation

Truck Drivers, Heavy Or Tractor Trailer
Truck Drivers-Light, Include Delivery/Route
Workers
All Other Motor Vehicle Operators
Grader, Bulldozer & Scraper Operators
Hoist & Winch Operators
Industrial Truck & Tractor Operators
Conveyor Operators & Tenders
All Other Material Moving Equipment
Operators

Unskilled labor

Helpers, Mechanic & Repairer
Helpers, Other Construction Trades
Machine Feeders & Offbearers
All Other Freight, Stock, And Material
Movers, Hand
Hand Packers & Packagers
All Other Helpers, Laborers & Material
Movers, Hand

Appendix B: Wood Cluster-Related Programs in Mississippi's Community College System

School	Program	Degree	Credits	Required areas of study
Copiah – Lincoln	Paper and Chemical Technology	A.A.S	66	Gen ed: English, Math, Communications, Social Science, Humanities Tech: Intro to Computers, Intro to Pulp and Paper, Industrial Mechanical Concepts, Pulping and Bleaching, Chemical Manufacturing Processes I-II, Environmental Protection, Internship
East Central	Forestry	A.A. Transfer	69	Gen ed: English, Psychology, Math, Chemistry, History, Fine Arts, Physics Tech: Botany, Forest Measures, Microcomputer Apps, Surveying, Dendrology, Soils
East Mississippi	Forestry	A.A.S	64 – 69	Gen ed: English, Math, Psychology, Communication, Tech: Survey of Forestry, Forest Mensuration, Dendrology, Soils, Timber Harvest, Silviculture, Elec.
Hinds	Forestry	A.A. Transfer	64	Gen ed: English (12), Algebra, Science (6), History (6), Fine Arts, Communication Tech: Forest Resource, Soils I-II, Forest Measurements
Holmes	Forestry and Wildlife	A.A. Transfer ¹	35	Gen ed: English, Calculus, Chemistry, History, Communication, Fine arts Tech: Botany, Zoology
	Forest Technology	A.A.S.	64	Gen ed: English, Humanities, Communication, Social Science, Tech: Dendrology, Survey of Forestry, Surveying, Forest Measurement, Silviculture, Botany, Timber Harvesting, Technical Electives (16)
Itawamba	Forest Technology	A.A.S.	67	Gen ed: Math, English, Social Science, Humanities Tech: Forest Mensuration, Survey of Forestry, Botany, Surveying, Silviculture, Soils, Dendrology, Timber Harvesting, Agricultural Economics, Forest Product Utilization
	Furniture Technology	A.A.S.	72	Gen ed: Math, English, Statistics, Social Science, Humanities Tech: Furniture Design I-II, Furniture Production I-II, Furniture Cost Analysis, Automation, Elective
Jones County	Pre – Forestry	A.A. Transfer	71	Gen ed: English (6), Science (20), Math (9), Humanities (6), Social Science (9), Fine Arts (3) Tech: Agricultural Economics, Soils, Administrative Communication
	Forest Technology	A.A.S.	65	Gen ed: English, Math, Geography Tech: Dendrology, Survey of Forestry, Forest Mensuration I-II, Silviculture I-II, Botany, Surveying,

¹ Program requires special courses that can only be take at Mississippi State University so students must transfer after their freshman year.

Mississippi Delta	Forestry	A.A. Transfer	66	Gen ed: Math, English, History I/II, Science, Economics, Statistics, Fine arts, Literature Tech: Statistics, Botany, Zoology I/II, Microcomputer Applications
Mississippi Gulf Coast	Forestry	A.A. Transfer	70	Gen ed: Science (12), English, Calculus, Communication, Social Science, Humanities, Fine arts Tech: Botany, Surveying, Forest Resources Survey, Dendrology, Soils, Forest Mensuration
Northeast Mississippi	Forestry	A.A. Transfer	69	Gen ed: Science, English, Math, Communication, Social Science, Humanities, Fine arts Tech: Botany, Dendrology, Survey of Forestry, Soils, Forest Products Utilization, Forest Measures
	Forestry Technology	A.A.S.	66	Gen ed: English, Math, Science, Fine arts, Social Science, Humanities Tech: Botany, Dendrology, Survey of forestry, Silviculture, Soils, Forest Measures, Surveying,
Northwest Mississippi	Forestry	A.A. Transfer	65	Gen ed: English, Math, Science, Fine arts, Social Science, Humanities Tech: Zoology, Botany, Dendrology, Intro to Forestry, Soils, Microcomputer Applications
Southwest Mississippi	Pre-Forestry	A.A. Transfer	67	Gen ed: English (6), Science (17), Social Science, Fine Arts, Western Civilizations, Math (6) Tech: Zoology, Botany, Introduction to Computers

IX. End Notes

¹ Regional Technology Strategies, *Exports, Competitiveness, and Synergy in Appalachian Industry Clusters*: A Report to the Appalachian Regional Commission, Washington, DC, Appalachian Regional Commission, 1997.

² Richard Vlosky and N. Paul Chance, *Identifying Employment Structure and Training Needs in the Louisiana Value-Added Wood Products Industry*, Tennessee Valley Authority, Paper 00-13, November 2000.

³ Kjeld Bülow, *Pilot Programme of Industrial Services for the Furniture Industry: Report and Recommendations*, Letterfrack, Ireland: Connemara West Centre, 1996.

⁴ Regional Technology Strategies. *Fulfilling the Promise: Building a Workforce for a Competitive Economy in the 21st Century* (Jackson: Mississippi State Board for Community and Junior Colleges, 2002).

⁵ Stuart Rosenfeld, "The Education of the Renaissance Technician," *Foresight*, Volume 4, Number 2, Fall 1986.