



MANPOWER TRAINING in Eastern Forest Industry: a Review and Assessment

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Abstract

Most training in forest industry takes place on the job and is more effective in sawmilling than in logging. Many training programs for woods workers have been ineffective because the rewards of the work are insufficient to attract capable people, leaving the industry to operate in a secondary labor market. Some characteristics of the work and of the technology suggest a need for training of machine operators in the industry, but others do not. An upgrading of pay and working conditions might attract workers of higher quality, thus reducing the need for training. There is a need for training of mechanics and managers, and this need will increase in the future.

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INTRODUCTION

THERE WAS A GROWING INTEREST in manpower training in the forest industries in the 1950's and 1960's. Periodic wood shortages in times of high end-product demand were often viewed as a labor supply problem and gave rise to the "woods labor problem" (Bromley 1957). For many people connected with the industry, the solution seemed to lie in recruitment and training programs, though closer analysis suggested that the labor supply was not the root of the problem (Pikl 1960; Hamilton 1963).

Adding to this interest were public manpower training programs that emerged in the 1960's with objectives, for a time, that seemed to coincide with the goals of forest industry. The Manpower Development and Training Act (MDTA) of 1962 was a public affirmation of the theory that high unemployment rates are the result of structural problems in the labor force and can be remedied by training and retraining workers for skilled jobs in an increasingly technological society. This seemed both the correct analysis and the probable solution to forest industry's labor problem.

By the mid-1960's, the training solution was so well established that the question was not whether to train but who and how to train (Campbell and Power 1966). At this time there also was concern within the forest industry about the effects of mechanization on skill requirements. Mechanization seemed to be taking hold in both the woods and the mills, and its growing importance was subsequently verified by data showing higher rates

of capital expenditures per employee and improved man-hour productivity (Bureau of the Census 1975; Bureau of Labor Statistics 1974, 1977; U.S. Price Commission 1972). Projections indicated that these trends would continue if the demand for wood products remained strong (Mooney and Tschetter 1976).

It was widely accepted that capital intensification and technological change had led to, and would continue to lead to, even higher levels of skill requirements in the industry (Granskog and Guttenberg 1973; Bureau of Labor Statistics 1974; Wolf and Nolley 1977). This raised questions about the performance of manpower training programs in the industry over the past two decades and generated concern about the probable need for training in the future.

THE STUDY

The objectives of this study were to (1) review and assess past experience in manpower training for forest industry; and (2) evaluate current and probable future needs for training. The study is limited to blue collar workers in logging and sawmills, and to the eastern half of the United States, though there are several important references to management and supervision and to the labor situation in Canada.

The first part of the report describes past experience with training programs. The second part is a discussion of the demand for training and relies on a conceptual approach to the economics of training as a means of understanding the training problems of the industry.

TRAINING IN THE FOREST INDUSTRY

Training is defined as any investment or activity resulting in the acquisition of a skill (Mincer 1962). Training methods used in industry vary from mere learning by doing, to informal training (unsystematic or systematic on-the-job instruction), to formal training in a classroom. All training methods are interchangeable to some extent; the optimal degree of formal training depends on physical, psychological, and economical factors.

Learning from experience on the part of already qualified workers is excluded from the definition of training because there is no deliberate decision on the part of management or worker, and its cost is unavoidable. Thus, we are concerned with on-the-job training (OJT) and formal training.

On-The-Job Training

The most prevalent means of training in any industry is on-the-job training (Myers 1971). One estimate is that at least 90 percent of all job knowledge in industry is acquired through OJT (Scoville 1969). Apparently, blue collar manufacturing workers believe that OJT is more helpful than other types of training (Piore 1968). And OJT is favored by industrial managers who claim it is essential in acquiring many skills, more effective than other training techniques, and more economical (Piore 1968).

But the prevalence of OJT probably cannot be explained fully by rational criteria. Piore pointed out that training is often an incidental byproduct of what are substitutions of inexperienced for experienced labor introduced to meet production goals—in many cases, management simply does not know how else to train. A more vigorous critic of OJT says the quality of instruction is generally very poor, and that much of OJT consists of “the novice teaching himself to do his job with relatively little assistance and with anticipated results” (Saltzman 1969).

It is apparent that the opportunity for OJT differs substantially between sawmills and logging operations. But there is insufficient information on which to make a general judgment about the quality of OJT in forest in-

dustry. Moreover, the quality of OJT is a matter of the attitude of management toward training and a matter of management's ability to design and carry out a training program.

Sawmills

On-the-job training is accomplished more easily in a sawmill than on a logging operation. First, worker activity in a sawmill is concentrated in a single place, making supervision and the establishment of a trainer-trainee relationship easier. Second, a sawmill worker, particularly one at a beginning level, usually works alongside a more experienced worker from whom he can learn. The occupational structure in a sawmill facilitates interjob learning and interjob movement. And third, because of these factors, training in a sawmill does not interfere with production to the extent it does in logging.

An inexperienced worker's first job in a hardwood sawmill is normally that of lumber handler, a job requiring little skill but offering an opportunity to learn from other lumber handlers. Here he can become familiar with the rudiments of lumber grading, a familiarity which is usually requisite to advancement to other jobs in the mill. The next step up the job ladder might be that of machine tailer working behind an edger or linebar resaw, where the worker's responsibility is to divert lumber or waste toward the next processing function. He has a chance to learn the operation of the machine, assist the operator in maintenance and housekeeping chores, and learn techniques of grade and volume recovery, all of which constitutes training for becoming a machine operator.

The two jobs of highest skill in the mill are head sawyer and sawfiler. Even these jobs are likely to be filled by people trained on the job, but in each case the trainees are chosen with greater selectivity and the training is more deliberate and formal. A head sawyer trainee will usually have proven to be a sensible and dependable worker in a number of other operator jobs in the mill. He is given instruction by the head sawyer and will gradually begin sawing for brief periods under the head sawyer's supervision. Sawyer training programs vary from mill to mill but usually require at least a year for the trainee to reach

the minimum acceptable level of skill. Training of a sawfiler is by similar methods and requires at least a year for acceptable proficiency.

Perhaps the greatest problem in training sawmill workers results from a technological change involving new equipment. This is not common since sawmill machinery tends to change only incrementally over time, and worker adaptation usually can be achieved without significant retraining. Where there is a substantial change in technique and equipment, as in the introduction of complex electronic equipment, training often begins with a visit by key sawmill personnel to the plant of the equipment manufacturer. Here the sawmill personnel are given instruction by members of the manufacturer's staff in the installation, operation, and maintenance of the equipment. Whether the new equipment represents technological change or not, manufacturer's representatives usually assist in the installation, "shakedown" operation, and initial training of mill personnel.

There are two skilled occupations in a hardwood sawmill for which OJT is normally supplemented by formal training, dry kiln operators and lumber graders. Training for entry into these positions and for maintaining currency of skills is offered through formal schooling, which will be discussed later.

Logging

Training of workers in logging usually cannot be by an apprentice system because it would be both impractical and unsafe (Hartman 1966). For example, in the felling of timber by chain saw, it would add greatly to the hazards of the job to have a trainee near the cutter and the falling timber. Also, the design of most logging vehicles precludes the presence on the vehicle of anyone but the operator. Safety in logging demands that cutters and operators work individually (Cadenhead 1965).

Because logging is not an "assembly line" operation like milling, the occupational structure does not facilitate interjob learning. And OJT in logging is likely to have a substantial impact on cost by interfering with production.

For all of these reasons, the logging operator places a high value on experience when

hiring new employees. Until recently, he could rely on a plentiful supply of rural laborers familiar with woods work by virtue of their farm background, but this is no longer true in many locations (Bond 1972b; Wolf and Nolley 1977). This situation has contributed to the "labor problem" in logging and has resulted in the industry both promoting public programs to train woods workers and hiring workers without experience.

The typical entry job for an inexperienced worker is chokersetter, tallyman, or general helper. From one of these jobs he can observe crew operations and the activities of more skilled workers. Depending on his aptitude, interest, and motivation, he may then progress up the job ladder by bucking logs on the deck and then trying his hand as a cutter; or he may become a wheeled-skidder operator. Working for the typical logging contractor, he will be given no deliberate training; what he learns will be picked up through his own attentiveness and initiative. If he is an employee of a larger company, he may receive instruction in the use and maintenance of equipment in the interest of safety.

The degree of training afforded an inexperienced logging worker depends largely on the attitude and practices of management. Supervisory training in the woods is not easy because operations are dispersed and a supervisor may see any one worker only once or twice a day. However, if management has a concern for safe and efficient operations, appreciates the contributions of training to the success of the operation, and is willing to take the time and incur the cost, the obstacles to supervisory training can be overcome. The following comments are those of an independent logger and sawmill operator in West Virginia.¹ The attitude represented by these remarks is, alas, unusual in the logging industry.

It has been my experience that labor is just as good as the management it receives . . . to be successful, a logger should be selective in who he hires. After (hiring him) it is your responsibility as manager to train him. After

¹Unpublished paper presented by O. Blankenship at fall meeting of West Virginia Forests, Inc., Charleston, W. Va., 1977.

you train him to do what you hired him to do, let him learn another job . . . training people is a continuous process on the successful logging job

Formal Training

Formal training is generally defined as training that takes place in an institution or classroom. For our purposes, we include in the definition clinics or workshops where the training is divorced from the production process. Included are programs offered by vocational high schools, postsecondary schools, employing firms and industrial associations, equipment manufacturers, and public forestry agencies. Special attention is given to public manpower programs and their relationship to forest industry.

Vocational high schools

The aim of vocational education is to provide young people with the fundamentals of specific occupations and to prepare them to acquire additional skills more readily either on the job or through additional schooling. (National Manpower Council 1954). Over the past several decades, vocational education has secured an established place in our system of secondary education despite strong opposition within and outside the field of education. Those who support it claim that vocational education is necessary to prepare for "real life" the large proportion of students who do not choose to go on to college. It provides students with an easier transition from school to the workaday world and allows them to enter the labor market at a higher wage than they would otherwise receive. Thus, it is claimed that vocational education is beneficial to the student, to industry, and to the community (Stormsdorfer 1972; National Manpower Council 1954).

Opponents of vocational education argue that it is too narrow, often preparing students for specific jobs or specific employers rather than providing them with a broad base for further training. A second criticism is that vocational education is ascriptive and steers less able or poorly motivated students, at a very early age, into lower status occupations on the grounds that they are not capable of more demanding or more prestigious work.

A third criticism is that vocational education "waters down" the curriculum to the point where students do not master the mental skills they are capable of acquiring. Finally, it is said that vocational education compels students to follow study programs that reduce their opportunity of going on to college if they wish to do so (U.S. News and World Report 1976; National Manpower Council 1954; Reubens 1976). The critics of vocational education emphasize the importance of a broad-based secondary education and argue that training for specific jobs should take place on the job (Mansfield 1968).

Perhaps the most strident contemporary criticism of vocational education is that by James O'Toole (1977). O'Toole argues that vocational education rests on four erroneous assumptions: that teenage unemployment can be attributed to a shortage of skills; that technological change is creating a labor market with increasingly high skill demands; that vocational education works; and that employers demand school graduates with specific skills. O'Toole says that what employers really mean when they talk about a shortage of skills is the absence of blue collar virtues, or the willingness to tolerate undesirable jobs. Regardless of whether one accepts O'Toole's arguments, they penetrate to the core of some of the issues important to this study and are worth keeping in mind as we proceed.

Vocational education programs in forestry and wood harvesting first came on the scene in the 1960's in the southeastern United States. They resulted from several factors, including a fear of labor shortages in the pulpwood industry, high youth unemployment that prompted expansion of Federal assistance for vocational education, and a decline in the number of farms and farmers that led the agricultural education establishment to expand its horizons beyond traditional agriculture.

With the aid of the American Pulpwood Association, state education departments and vocational education teachers developed courses that would give students the competence required for beginning jobs in timber harvesting. On the average, these programs consisted of 5 hours of study per week during

the senior year, with course content highly variable and dependent on the background and interests of the teacher. Programs eventually were established in the North, especially the State of Maine, and the Northwest, but reached the highest development in the Southeast. There, industry-school board advisory committees were established in each state and special courses for teachers have been supported by industry.

Evaluation of these programs is difficult, and this is true apparently of vocational education programs in general (Reubens 1976). Formal evaluations have never been made by participants, perhaps because program goals never seemed to be spelled out. A review of available information leads one to the conclusion that the principal objectives of these programs have been recruitment (or placement) of labor rather than the imparting of salable skills, and that even in this respect industry backers have not judged the programs to be successful. One observer believed that these programs offered "the best means of attracting intelligent and ambitious young men to choose a career in logging" (Glascok 1965); others were less sanguine after seeing a few years' results. The following quotation is from a 1970 memorandum written by an industry representative and circulated by the Department of Public Instruction of the State of North Carolina:

Because of the very nature of the pulpwood business, we have sometimes questioned the value of these high school courses in accomplishing their primary goal—that of providing new, young blood in the pulpwood business. There have been times when we felt that its secondary aim—that of improved public relations—was the main value of the course.

Some obvious public policy questions arise here, the answers to which may not be forthcoming without one becoming embroiled in the vocational education controversy already discussed. Should high schools train young people for work as specific as pulpwood logging? Should public funds and facilities be used to provide "young blood to the pulpwood business," or to further the public relations of the industry? Further, participation in these programs by the large pulp and paper com-

panies in the South may be subject to question because the companies, as a rule, rely on small logging contractors for most of their wood and, therefore, have not offered employment to vocationally trained loggers.²

The success or lack of success of these programs was revealed in a 1977 survey by the American Pulpwood Association (APA) (McKnight 1977) which showed that 44 participating schools in the Southeast had graduated about 3,250 students who had taken the course, of whom about 340 were employed in some way in logging operations. An APA survey of four schools in Maine and one in Vermont revealed a higher percentage of placement, with 90 of 247 graduates employed in forestry or timber harvesting (unpublished material supplied by the APA). In any case, the programs in neither area have been in existence very long (an average of 6 years in the Southeast, 4.5 in the Northeast), and the data may not be meaningful.

Postsecondary schools

Postsecondary vocational training has been subjected to many of the same criticisms, and defended by the same arguments, as high school programs. One study found postsecondary programs to be not greatly superior to high school training (O'Toole 1977). Yet such programs have increased rapidly in number in recent years. The "1975-76 Directory of Postsecondary Schools with Occupational Programs" (National Center for Education Statistics 1977) lists nearly 12,000 schools, over 100 of which offer instruction in the forest technologies. While many of these schools include instruction in wood harvesting and utilization, the majority offer a broad-based curriculum in forestry and gear the programs to the technician level. Only two schools in the East are known to specialize in training for entry level positions in wood harvesting; the following discussion is confined to these two programs.

The forest harvesting technology program at the Duluth (Minn.) Area Vocational-

²This situation seems to be changing as a result of changing industry structure. There is further discussion of industry structure in the section on labor market characteristics.

Technical Institute was established in 1969, reportedly at the suggestion of an industrial association and for the purpose of providing a skilled labor pool for the forest industry (Timber Producers Bulletin 1971). The program has one class per year of 46 weeks duration and enrolls about 30 students. Training is given in equipment operation and maintenance, hydraulics, welding, gas and diesel engine maintenance, accounting, job layout, scaling, surveying, and other related subjects. Of the 58 "competencies" required of each graduate, only 11 can be said to be related solely to wood harvesting, while 47 are of a general nature and widely applicable in industry.

The director of the program reported in January 1978 (personal correspondence with Mr. Jerry Back), that the total number of graduates to date was 125, that this represented 85 percent of those who had entered, and that 60 percent of the graduates went directly into woods work, 30 percent into closely related areas such as trucking and equipment mechanics, and 10 percent into unrelated employment.

The wood harvesting technology program at Washington County Vocational-Technical Institute at Calais, Maine, is similar to the one in Duluth but is more closely geared to specific woods skills (Krug 1975). Established in 1972, again at the urging and with the cooperation of forest industry, the program lasts 22 weeks. Overlapping of classes allows completion of six classes per year. Each class numbers about 15 to 18, with an attrition rate of 15 to 20 percent.

The primary objective of the program is to turn out cutters and skidder operators for the local pulp and paper companies; hence 55 percent of the instruction is in chain saw and skidder operations and 25 percent in maintenance. The school has an active recruiting program and attracts students from several Northeastern states. The number of applicants about equals the spaces available, with about one-third of the students attending on grants from the Comprehensive Employment Training Act (CETA). The director would like to be more selective in admitting candidates but the number of applications has not allowed this (personal interview with Mr. Joe

Krug 1977), and no selectivity is possible with CETA-supported students. Approximately 70 percent of the graduates find work in the woods or in related employment.

The two schools have other similarities. Each has earned a good reputation among employers. They both rely on informal feedback from employers as the only means of program evaluation. They depend on industry support not only for placement of graduates but also for donations of equipment. Neither program requires a high school diploma for admission. Both have low student-teacher ratios and a high cost per student. At Washington County, the average cost per student in 1977 was about \$5,000. This is in contrast to an average cost of less than \$2,000 for the institution as a whole. Students at both schools pay tuition (\$450 at Duluth and \$1,000 at Washington County), and buy their own books, clothing, boots, etc.

Both of these schools are to be considered successful if judged on the basis of meeting stated objectives. Several factors have contributed to this success: the training provides a reasonably thorough familiarization with equipment, processes, and basic mechanical principles; the large financial investment in the program results in adequate facilities, equipment and qualified—almost personalized—instruction; most of the students share the cost of the training and, therefore, enter with serious intent and a motivation to make the investment pay off; finally, the schools are located in areas of relatively intense wood industry activity and maintain close relationships with potential employers.

This is not to say that these schools necessarily represent a wise use of public funds. Some of the same questions raised in connection with high school vocational programs are applicable here. For example, it is legitimate to ask whether a \$4,000 net investment per student to train a worker for entry level employment in woods work is a justifiable public expenditure. But it might be shortsighted to regard these programs as wasteful or as mere subsidies to the forest industry. In areas where forest industry constitutes a major segment of economic activity, and where employing firms are large, pay average or better than average wages (as in Maine) and offer oppor-

tunity for advancement, it may be socially, economically, and politically astute to allocate public funds for the upgrading of human capital in that industry.

Nor can the criticism of early ascription that is leveled at high school vocationalism legitimately be applied to these postsecondary schools. The latter are outside the stream of basic education, the students who attend are more mature (some are in their mid-30's), and they have made a conscious decision to apply themselves in a special field at least partly at their own expense.

Industry training

Formal training programs are rare in the forest industry, and most of those that have been undertaken have been unsuccessful (Bond 1972b; Swan 1969). The reasons for the uncommonness of formal industry-supported training will be dealt with in detail in the section on demand. Suffice it to say that such programs have not been considered as needed except in unusual situations. The reasons for the lack of success of programs that have been attempted are low capability and poor motivation of trainees; disillusionment of trainees with working conditions, length of the work year, and pay, leading to high quit rates; and ineffective training methods (Deabay 1975; Ballantyne 1975; Bond 1972c; Thibodeau 1965).

In logging, formal training programs have been instituted to recruit employees in areas of labor shortage. This is the case in Maine, where manpower needs are high among the large forest industry companies operating in relatively remote areas. The manpower situation in Maine has been complicated by the tradition of using Canadian bonded labor and the political pressures to end this practice that have arisen during periods of high unemployment in the domestic labor force (Bond and Wolf 1978; Falk 1977). The threat of loss of bonded Canadian labor has prompted pulp and paper companies in Maine into repeated attempts to establish woods labor training programs.

The Great Northern Paper Company, for example, made four attempts to develop recruitment and training programs from 1950 to 1965, all of them unsuccessful (Thibodeau

1965). The reasons for these failures seem to have been the very same as those that made woods work unattractive in the first place; that is, hard manual labor, exposure to the elements, a short work year that limited income, and the poor public image of such an occupation.

It was not until the 1970's that company training programs in Maine began to show some success, with a relatively large proportion—Great Northern reports 75 to 80 percent—of the trainees going on to become productive woods workers. A number of factors have contributed to this turnabout. Mechanization of operations has reduced the physical hardships of the work, raised productivity and wages, and improved the self-image of the worker. Also, the companies have learned a great deal from previous experience and have upgraded the programs and placed them under the direction of professional personnel training specialists with sizeable budgets.

Current programs of the Great Northern Paper Company are conducted with careful attention to trainee selection. Most trainees are high school graduates and are attracted from other jobs rather than from the ranks of the unemployed. Program content and transition from training status to regular work are other areas that have been improved (Deabay 1975). The success of Great Northern's conventional woods training program, which lasts 10 weeks, has led the company to establish a second program of 6 weeks for equipment operators. Currently, all new woods employees are required to be certified through participation in one of these programs.

The training director at Great Northern reports that the cost per trainee is \$2,500 in the conventional program and \$3,000 in the mechanized program (personal interview with Mr. Dana Saucier, 1977). Quite obviously, such costs of training can be borne only by the larger firms that depend on company crews for a large share of their wood, and would be incurred only in situations where the woods labor supply is otherwise so precarious as to threaten pulpwood supplies and the continuous operation of the mill.

But formal training programs such as those in Maine have generally not been necessary in other parts of the Eastern United States

despite the fact that essentially the same skills are required of woods workers.³ This points up the special nature of the labor supply for timber harvesting in Maine and the difference in the structure of the industry there compared with that in other areas.

Public manpower training programs

During the 1960's, forest industry firms and associations participated in several training programs supported by Federal funds under the Manpower Development and Training Act. Most of the early (1960's) and unsuccessful industry training programs were undertaken with the assistance of MDTA funding (Swan 1969). A brief review of the short history of MDTA will be helpful to show that the goals of this program and those of forest industry came to a parting early on.

The MDTA had its origins in the automation scare that emerged in the 1950's. A key assumption on which MDTA rested was that a large number of jobs were awaiting workers with deficient or obsolete skills if only the workers could be trained or retrained to qualify for them. This is the so-called structural theory of unemployment, and to those who accepted it, the objectives of MDTA seemed to compliment the labor recruiting objectives of forest industry—or to almost any industry, for that matter.

Benefit cost analyses of early MDTA training efforts were favorable (Borus 1964; Stormsdorfer 1968), but these analyses reflected certain biases that were built into the programs and that tended to ensure success (Sewell 1971). The principal objective was to bring about a reduction in unemployment, and this led program administrators to choose the best educated and most competent individuals.

³This is not to say that other companies do not have effective training programs for their employees. Firms such as WESTVACO, Inland Container, and Weyerhaeuser have developed good OJT programs in the Appalachian Region. However, most large forest products companies in the East obtain only a small fraction of their wood by the use of company employees, and contractor employees do not have access to company training programs. The large companies in Maine are different because they do most of their own logging.

Not long after its inception, however, the original employment objectives of MDTA gave way to the broader objectives of the "antipoverty" program, and it was clear that MDTA was not reaching the "hard core" unemployed or the "disadvantaged." These shortcomings were remedied through a series of amendments to the original Act so that by 1968, 65 percent of the participants were considered disadvantaged (inexperienced youth, members of minorities, persons with limited education, the rural poor, and older workers).

As program objectives shifted from reducing unemployment to increasing the income of the disadvantaged, evaluations were less favorable (Main 1968; Somers 1968), and the mutuality of goals between MDTA and industry vanished. The objectives of MDTA in recruitment had become markedly dissimilar to those that would serve the forest industry's purposes, but the industry at that time was still in the process of learning its lesson that the success of any training program depends largely on the quality of the individuals selected for training (Perry et al. 1976).

The MDTA program in forest industry for which the most complete record is available is the Northeastern Regional Logger's School. This school was begun in May 1968, and was sponsored by the State of New Hampshire with the assistance of industry. Its objective was "alleviating the dependence of the logging industry on Canadian labor." An industry committee that evaluated the school in January 1969 (APA 1969), gave the school good marks on the thoroughness of its recruiting effort and its training techniques, but suggested that the screening of potential trainees should be improved to "determine whether the prospect really wants woods work."

That some of the trainees did not really want woods work is evident in the enrollment data. Of the 160 trainees referred to the school through January 1969, 73 had dropped out, 63 had graduated, and 24 were still in the program. Soon thereafter, the school was discontinued because of the termination of Federal assistance under MDTA. During its first 9½ months of operation, the school trained "less than 100 men," with placement "probably in the 35 to 40 percent of graduates

range." One official closely associated with the school attributed its placement problems to geography: the school was in New Hampshire but the most likely employers were in northern Maine. The total cost of the school was \$239,000 or about \$6,000 to \$7,000 per graduate placed in woods work. These are 1969 dollars and are to be contrasted to the \$2,500 to \$3,000 cost per trainee that Great Northern Paper Company reported in 1977.

Public manpower programs to train loggers in Canada have achieved similar results and have been better documented. An evaluation by the Forest Engineering Research Institute of Canada (Scott and Cottell 1976) revealed high attrition rates among training graduates. Programs in Canada were sponsored either by industry or directly by Canada Manpower. Industry data showed that only 43 percent of the graduates were retained in forest industry for 1 year. Canada Manpower results were worse, showing only 29 percent of graduates employed in forest industry 3 to 4 months after completing training. These high attrition rates were blamed on improper selection of trainees and insufficient attention to the placement of graduates. Significantly, the authors say: "However, training programs should not be held responsible for turnover of new workers that is attributable to poor job or community conditions, or to better economic opportunities. Solutions to these problems lie elsewhere" (Scott and Cottell 1976, p. 52).

Training by equipment manufacturers

Training for operators of newly purchased equipment has already been discussed under the subject of OJT. But some equipment manufacturers, particularly those that make modern, complex logging machines, offer formal classroom training for mechanics employed by customer firms. When these programs were initiated, they usually consisted of several days of classroom study emphasizing the theory of the electronic circuitry, and depended on the experience of the mechanic to enable him to make the required application to the hardware. However, with the increasing complexity of the machines and the lack of sophisticated knowledge among custo-

mers' mechanics, the training was made more comprehensive and longer, up to 2 months in one case (Willows 1976).

Training of operators is a matter of concern to machinery manufacturers because a machine's performance depends on the competence of the operator. Most manufacturers have participated in training programs such as those already discussed, usually with disappointing results. In their view, one of the chief obstacles to training is the high rate of turnover, not only among customer's machine operators, but also among their own technical sales people. As a result, the extent of operator training offered by most manufacturers is limited to the salesman or serviceman spending an hour with the operator at the time of delivery.

Not surprisingly, logging managers have a low opinion of the training services available from manufacturers. Experience has shown loggers that the training of both mechanics and operators is one of trial and error, and the result is low production and high costs until the required experience is gained to operate the equipment within its capacity and reduce downtime to an acceptable level.⁴

Programs of public forestry agencies

Public forestry agencies such as the USDA Forest Service, state extension services, and state forestry agencies offer on an irregular basis training programs in some of the technical aspects of logging and lumber processing. These agencies often work in cooperation with industry associations or individual firms, and the sessions are usually 1 to 3 days long. In timber harvesting, the most common subjects are log grading and logging road construction, while courses in dry kiln operation and lumber grading are commonly offered to lumber producers.

In 1973, the Forest Service commissioned an evaluation of its Forest Products Utilization (FPU) Program, and because the FPU Program is representative of all efforts in this field, the evaluation is worthy of mention. The

⁴Parker, E. Operating whole tree chipping systems. Unpublished report. WESTVACO, Covington, Va. 8 p.

frequent use of generalizations and the lack of rigor in the evaluation report (Greenacres Consulting Corporation 1973) illustrate the difficulties of assessing the effectiveness of an education program, but one passage from the report seems noteworthy.

FPU staffers across the Nation have contributed to or participated in (as instructors) numerous group training sessions ranging from lumber grading classes for an individual company through log bucking to grade sessions for the total membership of a particular trade association. . . . The results have been as varied as the topics treated. Some classes, e.g., the dry kiln operators courses, have been most valuable and many unsolicited testimonials to their value can be found in FPU files. Other classes have been complete failures, having been attended only by individuals affiliated with the FPU program or having been cancelled for a lack of interest.

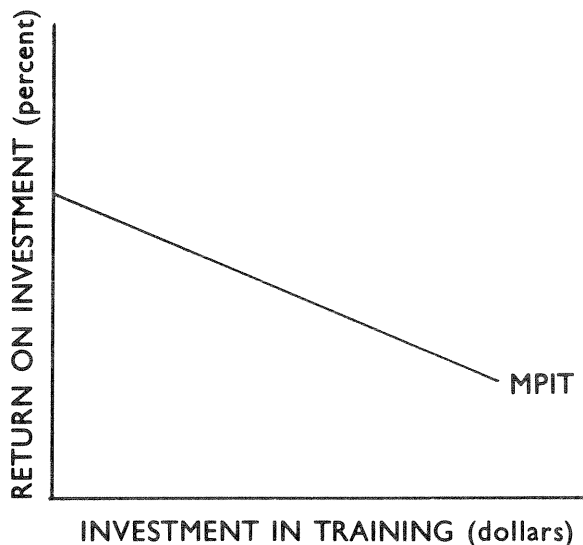
One area of great potential contribution to the forest industry not being filled by public agencies is training in management. Logging and sawmill operators and managers are often weak in management sciences and personnel relations (Latham and Kinne 1971; White 1965); yet the educational efforts of public agencies tend to avoid these subjects and concentrate on technical processes and marketing. But it is possible that training in management could, in the long run, have a greater impact on efficient utilization of both the timber resource and manpower. Two difficulties are apparent here, however. One is that public agency personnel usually are not knowledgeable in this area and would have to bring in other specialists. The other difficulty is that managers in the industry who are in greatest need for such training might not be willing to participate.

THE DEMAND FOR TRAINING IN FOREST INDUSTRY

We turn now from a descriptive to a conceptual treatment of the subject to better understand the problems associated with training in forest industry and to get a glimpse of what the future might hold. The tool used is demand analysis.

The demand for training in an industry can be viewed as a schedule of the anticipated returns on investment in training activities. In Figure 1, a line representing the marginal productivity of investment in training (MPIT) results from the relationship of various levels of investment in training (horizontal axis) and the expected rate of return on that investment (vertical axis). Successive levels of investment are subject to diminishing rates of return. The model is applicable to an industry, a firm, or even an individual. Here we will make use of it in analyzing those factors that influence forest industry firms in their decisions about whether to invest in training.

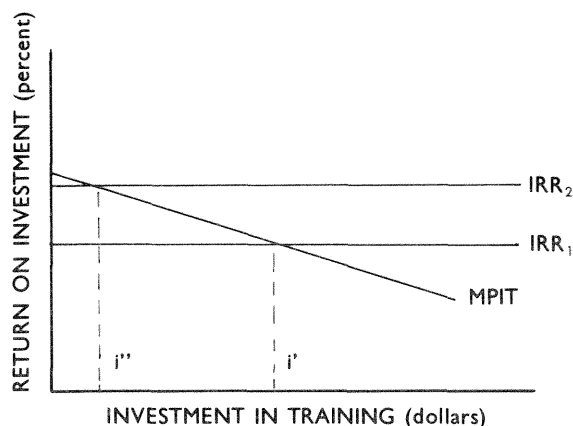
Figure 1.—Marginal productivity of investment in training.



To complete the model there must be, of course, a standard against which training investments can be judged, and for this purpose we will use a constant internal rate of return (IRR). Managers will invest in training only if the MPIT as they perceive it exceeds the IRR. In Figure 2, for example, investment in training beyond point (i') would be unattractive if the internal rate of return was at IRR_1 , and a much lower level of investment (i') would be called for if IRR_2 prevailed.

No manager considers his training needs or opportunities in such a formal and abstract

Figure 2.—Comparison of investment in training with alternative investment within the firm.

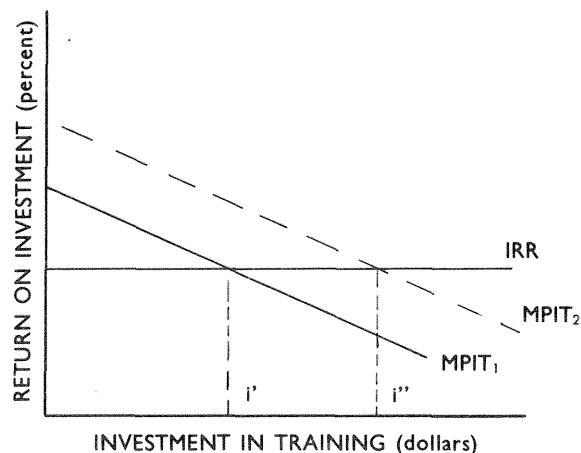


manner. Nevertheless, he is not likely to undertake a training program unless he thinks it will be profitable, and this device can be helpful in identifying the factors that are relevant to his decision and what sort of influence those factors have. Each circumstance in a firm or industry that tends to increase the need for training tends to raise the MPIT (Fig. 3). Conversely, any circumstance that decreases the need or desirability of training tends to depress the MPIT. In the discussion that follows, all of these factors have been grouped under three headings: occupational characteristics, the rate of technological change, and labor market characteristics.

Occupational characteristics

The *level of skill required for entry* is an important determinant of the need for training. The higher the skill required on beginning jobs, the greater the incentive to provide training for new and inexperienced workers. As was pointed out in the earlier description of job ladders in logging and sawmilling, and as other observers have noted (Bond 1972b; Cottell 1972), most firms in the industry have entry level jobs that require little skill, so there is little incentive for management to undertake preemployment or vestibule training. Exceptions may be where there is a labor supply problem and the training program serves as both a recruiting device and a means of placing new employees in high-productivity

Figure 3.—The effect of factors that increase the need for training on MPIT and investment in training.



jobs in a short time, as was true in the case of the Great Northern Paper Company.

A second occupational characteristic that affects the productivity of investment in training is the *opportunity for interjob learning*. Such opportunities are not readily available in timber harvesting; thus the influence of this factor is to raise the MPIT in harvesting operations. In sawmilling, however, the concentration of workers in a continuous production line has the opposite effect.

The *degree of supervision* that is possible is a third factor, and here the situation is similar to that of interjob learning. Supervision is difficult on a logging operation and relatively easy in a sawmill, thus tending to raise the MPIT in logging and reducing it in milling.

A fourth consideration is the *range of skills required*. Some logging operators, particularly the smaller ones, need to have each of their crew members familiar with a number of different jobs—perhaps even all of the jobs in the operation. This increases the crew's flexibility and prevents shutdowns when a crew member is absent. The same holds true in small sawmills, and the effect is to raise the MPIT in both logging operations and sawmills of small size. This factor is likely to be less important in large firms where more than one employee is available for any one occupational slot.

The fifth occupational factor is the *degree*

of danger present on the job and the importance of safety. Both logging and sawmilling are among the most hazardous of industries and incur high costs in the form of workmen's compensation insurance. There is ample incentive in both industries for investment in training for the safe use of equipment.

The final occupational characteristic that influences the MPIT in forest industry, and perhaps the most important one, is the *similarity of skills from firm to firm*. Becker's (1964) theory of general and specific investments in human capital is instructive here. *General* training results in skills that are useful not only to the employing firm but also to its competitors. *Specific* training is useful only to the employing firm. After completion of training, a specifically trained worker is attached to the employing firm if he wishes to make use of his skill, while a generally trained worker can "sell" his skill elsewhere. Since the technology of both logging and milling is similar among firms in each of the industries, training in both industries is general in nature.

Under such circumstances, a firm will not undertake training unless its cost is borne by someone else; that is, by the employee or the public. If it is to be the employee who pays, the "payment" will ordinarily be acceptance of a wage lower than that of the fully trained worker while having the same or nearly the same work responsibilities. To put this in terms of the marginal productivity theory of wages, the worker's "wage" must cover his contribution to production and the cost of his training, leaving his actual wage at a lower level until he is fully trained.

The generality of skills and training in the forest industry is a distinct disincentive for employers to incur training costs (Bond

1972b). The theory of general versus specific training also helps explain why pulp and paper companies in Maine are willing to train woods workers while companies elsewhere are not. The geographic isolation of the Maine companies and the lack of alternative employers serve to make the training specific rather than general because the trainees have limited opportunity to transfer the skill to another employer unless they are willing to relocate.⁵

The effect of all six occupational characteristics is summarized in Table 1. It is evident that in logging, these occupational characteristics present both incentives and disincentives for investment in training, while in sawmilling there is a predominance of disincentives.

The rate of technological change

It is a common assumption that technological change raises the level of skills required and leads to the need for training. The reasoning is that mechanization results in the introduction of machinery of greater complexity, that workers manning and servicing this machinery need higher types of skills, and that, therefore, employers see an upward shift in the MPIT. This has been the widespread view in the forest industry over the past decade as mechanization and capital-labor ratios have increased (Bureau of Labor Statistics 1974; Jaakko-Poyry Company 1975).

⁵The training program of Great Northern seems to be one in which the company and the trainee share the cost of training. The trainee receives a wage that is roughly two-thirds of that paid to a "Class A" or experienced worker. After the training period, he becomes first a "Class C" and then a "Class B" worker before reaching "Class A" status about 6 months after training. At each succeeding class level, he receives a higher wage.

Table 1.—The positive (+) and negative (–) effects of occupational characteristics on the productivity of investment in training

Occupational characteristics	Logging		Sawmilling	
	Small firm	Large firm	Small firm	Large firm
Entry level skill required	–	–	–	–
Opportunity for interjob learning	+	+	–	–
Degree of supervision possible	+	+	–	–
Range of skills required	+	–	+	–
Degree of hazard	+	+	+	+
General vs. specific skills	–	–	–	–

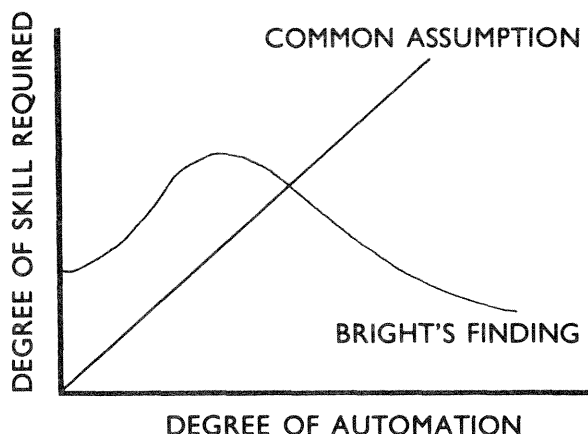
But there has been some important research that questions the validity of the assumed relationship between technological change and skill requirements. On the basis of studies in a number of industries, James Bright concluded that the upgrading effect of automation has been greatly exaggerated (Bright 1966). "On the contrary," says Bright, "there was more evidence that automation has reduced the skill requirements of the operating work force."

Bright was not the first to advance the idea that automation reduced skill requirements. Veblen (1958) wrote about it in 1904. In 1954, the National Manpower Council reported that employers were convinced that specific skills were not of paramount importance because the highly skilled, multioperation jobs in industry were being reduced to a series of simpler jobs that could be handled by workers of lesser skill (National Manpower Council 1954).

But Bright was the first to do empirical research on the subject. His analysis showed that many types of automated machinery require less operator skill after certain levels of mechanization are achieved, and that many jobs formerly requiring long experience and training are reduced to easily learned, machine-tending jobs as a result of automation.⁶ In Figure 4, Bright's conclusion about the relationship between automation and skill demands is compared with the common assumption.

One suggestion that comes from Bright's work is that the degree to which mechanization in the forest industry affects skill requirements can be determined only by investigating each job and the degree to which it is altered by increasing the sophistication of machinery. Constraints on resources limit us to a much more modest approach here. Three recent changes in the technology of both logging and milling are assessed in terms of their effect on skill requirements. These

Figure 4.—The relationship between automation and degree of worker skill required.



changes are: in logging (1) natural spar tree to portable steel tower, (2) chain saw to tree shear, and (3) wheeled skidder and piece loader to whole tree yarder and chipper; and in milling (1) band or circular saw to chipping headrig, (2) manual to automatic sorter and stacker, and (3) manual to automatic trimmer. All of these changes have been cited as mechanical improvements that have increased man-hour productivity in recent years.

Bright sharpened the definition of a "skilled worker" by examining the demands machinery makes on the worker. He drew up a list of 12 categories of contributions for which the worker receives compensation. Eleven of Bright's categories are used here; the twelfth (seniority) seemed inapplicable to this analysis. A judgment on the effect of each technological change on each worker contribution was made on the basis of a consensus of a group of faculty members in the Division of Forestry at West Virginia University. The results of the assessment are shown in Table 2. Each letter L, S, or H means that the technological change was judged as resulting in a lower, the same, or a higher worker contribution, respectively.

The arbitrariness with which the judgments were made precludes the drawing of any firm conclusions. But on the basis of some of the recent and important technological changes in the industry, it seems that the process of

⁶Bright draws no distinction between automation and mechanization. Ordinarily, mechanization is defined as the process wherein machinery takes the place of human or animal effort, and automation is the latter stage of mechanization where control of the machinery becomes increasingly automatic.

Table 2.—Changing contribution of workers with changing technology in logging and sawmilling^a

Worker contribution ^b or sacrifice traditionally receiving compensation	Logging			Sawmilling		
	Natural spar tree to portable steel spar	Chain saw to tree shear	Wheeled skidder and piece loader to whole-tree yarder and chipper	Band or circular saw to chipping headrig	Manual to automated sorter and stacker	Manual to automated trimmer
Physical effort	L	L	L	L	L	L
Mental effort	S	H	L	L	S	S
Dexterity	L	L	S	L	L	L
General skill	L	H	S	S	S	S
Education	H	H	L	S	S	S
Experience	H	H	L	S	L	S
Exposure to hazards	L	L	L	S	S	S
Acceptance of undesirable job conditions	L	L	L	S	S	S
Responsibility ^c	S	H	H	L	H	S
Decisionmaking	L	H	L	L	L	S
Influence on productivity	H	H	H	S	H	H

^aL = Lower; S = Same; H = Higher.

^bRefers to operators and helpers but not to mechanics, engineers, or supervisors.

^cSafety of equipment, of the product, of other people.

mechanization in logging has placed heavier demands on a number of worker contributions that might be included in a definition of skill. Note, however, that the most recent of the technological changes, the switch from wheeled skidders and loaders to whole-tree yarding and chipping, is judged as requiring greater worker contribution in only 2 of the 11 categories. Relating the logging portion of Table 2 to Bright's curve in Figure 3, it seems that while logging is still at an early and high point on the evolutionary curve of mechanization and skill demands, it may have reached the apex of the curve so that future technological change will not require greater skill among workers.

In contrast to the analysis of logging, that of sawmilling suggests that technological change may be lessening the demand for skills and that automation of many processes is reducing not only the physical but also the mental effort of workers. The automation of sawmill processes was foreseen by at least one expert two decades ago. In testimony before the U.S. Senate Select Committee on Small in Business in 1959, Fred C. Simmons described the sawmill of the future: "The sawmill proper will employ no more than five or six men. None of these will do hard physical work. This will be done by machinery. So will much of the mental work too. Many machines will be controlled by other machines" (U.S. Senate Select Committee on Small Business 1959).

It should be kept in mind that the foregoing discussion has been concerned with the skill of machine operators and helpers and not with engineers and mechanics. In most any situation involving heightened sophistication of machinery, there is a greater input on the part of the machine designer and the mechanic who keeps the machine running. Comments by operators of whole-tree yarding and chipping systems emphasize the importance of good mechanics on the job.⁴ A recent Canadian study (Boyd 1977) showed that 1 of every 4 hours on logging jobs is lost because logging machines are out of service, and that up to three-quarters of the downtime can be eliminated through proper maintenance and repair procedures.

The implications of technological change on

training in the forest industry are unclear, to say the least. But the following tentative conclusions are offered.

- The process of mechanization in the industry should probably be viewed as one in which skill demands, rather than increasing across-the-board, become concentrated in a few key occupations, primarily those that have the responsibility for mechanical maintenance. Thus the MPIT of mechanics has become very high in relation to that of other workers.
- The evolution of mechanization in logging may still be at a stage where it enhances the MPIT of machine operators, but in the most highly mechanized operations this may not be true.
- Technological progress in sawmilling has probably reduced the skill requirements and the MPIT of machine operators.

Labor market characteristics

The need for training in forest industry depends to a great extent on whether there already are qualified workers in the labor force and the ability of the industry to attract and hold them. Since the labor situation in forest industry shows considerable change over time, among geographic areas, and among firms of different size or even different management philosophies, this subject can be discussed only in the broadest and most general of terms. Perhaps the best approach to the subject is through a brief historical sketch.

Forest industry has had an ample supply of labor over most of the post-World War II period. During the 1950's and 1960's, there was a large surplus of rural labor resulting from declining demand for farm workers. Employment in mining, another source of rural employment, was also dropping during this period. While many unemployed rural people migrated to urban areas in search of work, many others remained, caught in the backwash of postwar prosperity that was sweeping most of urban America (Marshall 1974; Sufrin and Buck 1963). Those who remained in rural areas contributed to a large labor pool for rural industries such as the forest industry (White 1965; Manthy and James

1964). Many of these people were readily employable because their farm background had given them familiarity with logging and milling equipment and practices (Wolf and Nolley 1977; Bond 1972a; White 1965).

Throughout this period, both segments of the industry were characterized by a large number of small firms, many of which were in and out of production as markets fluctuated. In both woods and mills, layoffs were common among the smaller firms when markets turned downward. In the woods, workers could rarely depend on more than 40 weeks of work because of adverse weather. The pay was low, the work physically demanding and hazardous, and working conditions were often poor (Wolf and Nolley 1977; Bond 1972b; Cottell 1972; White 1965; Hamilton et al. 1961).

Because of these conditions, workers attracted to the industry tended to be poorly educated and lacked motivation and reliability (Bond 1972c; Hamilton 1963). They tended to look upon the work as temporary and were quick to leave when another opportunity arose. Both quit rates and absenteeism were (and still are) among the highest in all of industry (Wolf 1977).

Much of what has been written about the labor problem of forest industry has described the problem as one in which the industry could not recruit sufficient numbers of workers with required skills, given the wages and working conditions that the industry felt it could offer (Granskog and Manthy 1970; Bromley 1957; Jenkins 1968). When fears of a wood shortage erupted, as they do periodically in times of high market demand (particularly in the pulpwood industry), the solution advocated by many was an active program of recruitment and training. In the case of pulpwood in the Southeast, closer analysis implicated the sharp increases in demand for wood and the inability of the wood delivery system to respond readily, rather than deficiencies in the labor supply (Hamilton et al. 1961; Pikel 1960).

Another and somewhat different way of viewing the labor problem in forest industry results if we ask the question: Is it really a deficiency of skills that has posed a problem for the industry, or does the deficiency lie in other attributes of the workers? In this re-

gard it is helpful to consider the theory of the dual labor market.

Whereas traditional labor market theory is based on the concept of a single market, the theory of the dual labor market holds that there are actually two markets—primary and secondary. The labor market conditions that have prevailed in much of the forest industry are similar to those described for the secondary market.

The primary market, according to Piore (1970), who formulated the theory, offers jobs that provide high wages, good working conditions, employment stability and job security, and chances for advancement. The secondary market offers jobs with low pay, poor working conditions, high variability in employment, and little opportunity to advance. But not only are there great differences between jobs in the two markets, the people who occupy them tend to exhibit different behavior. According to Piore, "the most important characteristic distinguishing primary from secondary jobs appears to be the behavioral requirements they impose upon the work force, particularly that of employment stability. Insofar as secondary workers are barred from primary employment by a real qualification, it is generally their inability to show up for work regularly and on time."

Piore suggests that entry into the primary labor market is not denied by lack of skill—recall we have already noted that most employers in industry are not greatly concerned with specific skills when hiring—but by the lack of a work ethic that gives the worker the attitude and motivation appropriate to the demands of the job.

If the theory of a dual labor market has any applicability to the labor problems for forest industry—I believe it does—then the industry's problem has not been a shortage of skilled labor as much as a failure to "buy" the desired worker behavior. The syndrome of quality jobs in terms of wages, working conditions, and other factors, matched by the quality of the workers attracted to those jobs, has existed. As one progressive logging manager put it, "There's no such thing as cheap labor."

If this analysis is accurate, then recruitment and training programs in the industry

are doomed to failure unless the job qualities are upgraded. In the absence of such upgrading, the types of workers attracted to training programs are likely to be the same as those attracted to the jobs, and will exhibit the same degree of motivation, absenteeism, and quit rate.

To what the extent firms in the forest industry have problems of labor supply, it is difficult to see how those problems can be solved by training submarginal workers for submarginal jobs (Granskog and Manthly 1970). A more promising solution is creating jobs that will enable the industry to bid for workers in the primary labor market.

It is significant that the few successful training programs in the industry, such as that of Great Northern Paper Company, provide relatively high wages and are administered by those who can be selective in recruiting trainees. These factors, together with the quality of the resulting work force, suggest that Great Northern is tapping the primary labor market.

To some extent, better jobs are being created as a result of mechanization and changing industry structure. A key factor in promoting these changes is the turnaround in rural employment (Beale 1976; Marshall 1974). Farm employment has stabilized and employment in mining is increasing. A trend toward rural industrialization has created greater opportunities for manufacturing employment in small towns. All of this constitutes a move toward economic rebirth of rural areas that is predicted to continue in the foreseeable future, and will increasingly force the forest industry into greater competition for labor.

There are additional factors that will tend to intensify the competition for labor in the future, including a decline in both the rate of entry of young people into the labor force in the 1980's and the number of people available for jobs that the U.S. Department of Labor describes as "lower level" (Department of Labor 1976; Wool 1976).

Mechanization—through its effect on capital-labor ratios, labor productivity, wage rates, and job conditions—offers the industry an opportunity to compete for labor under a tighter labor supply. But there will remain

some strong disincentives to large infusions of capital and conversion to fully mechanized operations, especially in logging. The characteristics of the timber resource—its scatter, size, and accessibility—will continue to pose constraints on profitable capital input. Highly mechanized operations often require clearcutting of timber, and environmental constraints may limit its use. Increasing fuel costs and the cost of capital equipment itself will have to be reckoned with.

And then there are certain institutional factors that favor small, labor-intensive operations, such as workmen's compensation statutes that permit small employers to avoid paying insurance premiums. All of these factors tend to impede the process of mechanization, and together with higher labor costs, constitute a stern test of the industry's efficiency. The real skill problem in the future is likely to be in management rather than labor.

SUMMARY

Most of the training of workers in the forest industry is informal and takes place on the job. It is difficult, if not impossible, to assess the extent and quality of this training; but studies in other industries have shown that this method of training is favored by both management and labor. On-the-job training is easier to accomplish in sawmilling than in logging because of the concentration of workers and the "assembly line" nature of millwork. However, in both segments of the industry there is a reluctance to incur training costs because of the transferability of skills from firm to firm. A critical element in effective on-the-job training is the quality of management and supervision. The small operator in the forest industry is usually ill prepared to fulfill the managerial requirements of effective on-the-job training.

There has been little formal training in forest industry, and many efforts have proven unsuccessful—the chief reason apparently being the quality of trainees attracted to the programs. Notable exceptions include programs offered by two postsecondary vocational-technical schools and a large pulp and paper company in Maine. Formal training programs have shown greater success when

trainees were selected carefully and were guaranteed a good wage during and after training.

Vocational training programs in wood harvesting at the high school level are of questionable value, and support of such programs by the forest industry may not be justifiable from the standpoint of social welfare or the long-term interests of the industry. In the long run, the industry can best be served by having access to a labor force that is educated to its highest potential, adaptable to changing technology and skill requirements, and motivated toward high performance and self-improvement.

Training for forest industry occupations in connection with public manpower programs has been a failure, both in the United States and Canada, largely because the goals of these programs have differed from the recruitment and training goals of the industry. There has been little opportunity to screen trainees, and the relatively low pay and poor working conditions in the industry have precluded the attraction of competent trainees.

Manufacturers of equipment for the forest industry provide little training for equipment operators but are beginning to offer an important service in the training of mechanical maintenance personnel. This is one of two areas in which the need for training is most acute and is likely to continue as machinery becomes more sophisticated.

Training programs offered by various Federal and state forestry agencies tend to concentrate on technical skills and ignore the needs for management training, which is the second area of acute need.

There is reason to question the commonly held assumption that increasing mechanization raises the level of required skills and leads to a need for more skill training. The assumption is probably more valid in logging than in sawmilling but even in logging the greatest need for intensified skill training as a result of mechanization is in the occupation of mechanic rather than machine operator.

What the forest industry has often viewed as a lack of skills might more accurately be described as a lack of motivation and unsatisfactory work behavior among workers attracted to the industry. The industry may be

operating in the "secondary" labor market, and thus recruiting and training submarginal workers for submarginal jobs.

The long-term oversupply of labor in rural areas has been the key factor contributing to low wage levels and poor working conditions in forest industry, but the rural labor supply is now changing and forest industry faces greater labor competition in the future. The industry may be able to compete in this labor market by mechanization and job upgrading, and there is evidence of a trend in this direction. However, there are a number of disincentives to mechanization with which the industry must contend, and there is no assurance that the pace of mechanization will be adequate to counter increasing labor costs.

In the future, most of the skills needed by the industry may be available in the more highly industrialized rural labor market and among the more highly educated workers in that market. Except for a few isolated areas where forest industry is the predominant economic activity, and where a few firms and public institutions may continue to offer formal skills training, on-the-job training should be adequate for the industry's needs for machine operators and helpers.

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