Silviculture worker certification in Canada?¹

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This paper begins by identifying constraints faced by the silviculture industry when making decisions on human resource development. It identifies market failures that may result in an underinvestment in silviculture training. The paper then provides evidence of underinvestment in training and discusses the role of government in influencing investments in silviculture training, particularly its intervention through regulatory measures such as silviculture worker certification.

Part 1 presents theory and evidence concerning certification, which is defined both as an act and a process. It acts on the quality of education and training provided and ultimately on the quality of labor employed. Some functional and dysfunctional aspects of certification are touched upon. The process of certification includes the objectives of certification, intended target groups, certification and training standards, and certification structure. Assessing the human resources employed in the silviculture industry is an important step.

The merits and shortcomings of certification are presented in Part 2. Key issues related to forest management are addressed to provide a balanced portrait of silviculture worker certification. The merits range from increasing product quality to reducing on-site injuries. Shortcomings include the transaction costs of certification, a phenomenon called the "generation gap," and jurisdictional control. Issues between the merits and shortcomings of certification are also included.

Part 3 discusses alternatives to silviculture worker certification. Taxation, subsidies, and the dissemination of information on the benefits of training are other forms of intervention influencing decision making in the private market.

L'auteur, après avoir d'abord déterminé les contraintes auxquelles les entreprises sylvicoles doivent assujettir leurs décisions concernant le perfectionnement de leurs ressources humaines, cerne les défaillances du marché qui risquent d'aboutir au sous-investissement dans la formation sylvicole. Donnant ensuite des preuves de ce sous-investissement, il discute de l'influence que l'État exerce sur l'investissement dans la formation sylvicole, notamment par la réglementation, par exemple, de l'agrément des travailleurs sylvicoles.

La première partie est un exposé de la théorie de l'agrément et des faits concernant l'agrément, lequel est défini à la fois comme une action et comme un processus. L'agrément agit sur la qualité de l'instruction et de la formation données et, au bout du compte, sur la qualité de la main-d'oeuvre. On y effleure certaines de ses fonctions et dysfonctions. Le processus de l'agrément englobe les objectifs et le mode d'organisation de ce dernier, les groupes cibles ainsi que les normes d'agrément et de formation. L'évaluation des ressources humaines employées dans la sylviculture constitue une étape importante.

Dans la deuxième partie, on présente les avantages et les inconvénients de l'agrément. On évoque les enjeux de l'aménagement forestier afin de présenter un portrait équilibré de l'agrément des travailleurs sylvicoles. Les avantages procurés par l'agrément vont de l'augmentation de la qualité des produits à la réduction des lésions professionnelles. Les inconvénients comprennent les coûts de transaction de l'agrément, le phénomène appelé « fossé des générations » et la juridictionnalisation. Il est également question des enjeux entre les avantages et les inconvénients de l'agrément.

Dans la partie 3, on traite des solutions de rechange à l'agrément des travailleurs sylvicoles. La fiscalité, les subventions et la dissémination de l'information sur les avantages de la formation sont d'autres formes d'intervention qui influent sur la prise des décisions dans le marché privé.

Introduction

The Canadian silviculture industry consists of silviculture service agents, whether public or private, primarily engaged in forest renewal, site preparation, stand tending, and nursery activities.

Over the past decade, the silviculture industry has grown because of increased expenditures by federal and provincial governments and by industry. Between 1977 and 1991, approximately 4 billion dollars were spent on silvicultural activities, representing nearly 30% of all expenditures in forest management (Forestry Canada 1992). Results are already measurable by the number of hectares silviculturally treated. For example, in 1980 approximately 340 000 ha were treated, whereas in 1991 treatment included some 1 000 000 ha. These silvicultural treatments consist of basic and intensive practices such as tree planting and stand tending.

Labor represents a key to most silvicultural activities such as tree planting. Growth in silvicultural treatments has led to a rapid expansion of the Canadian silviculture labor force, with

some estimates placing its membership as high as 50 000 workers. Although a sizable group, this labor force has been characterized as underskilled, undertrained, and transient:

"Job training is very crucial for achieving productivity and quality work ... if employees do not know correct methods, they will plant trees which die and they will have more accidents in the bush. This committee [promotes] occupational standards through modular programs which can lead to certification." (SJAC 1988).

"... poor practices caused by lack of knowledge and understanding at the field level can defeat the best of plans and systems. In British Columbia we are well beyond the point where 'learning on the job' in absence of formal training and apprenticeship programs is an acceptable training technique. Thorough and intensive training must take place before workers are placed in the field." (FRC 1991).

"Not all workers have the knowledge and skills necessary to be safe, productive workers ... In some cases workers have poor work habits, in other cases equipment is poorly maintained or cutting operations are not well organized." (NB 1989).

An under-endowed labor force can contribute to rising forest management costs, poor product quality, rising occupational

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injuries, high job turnover rates, and a perception that employment within silviculture is short term.

In Canada, it is broadly held that there is a general underinvestment in silviculture training. However, this phenomenon is not exclusive to the silviculture sector, but rather is common throughout the Canadian economy; Betcherman (1993a) acknowledged that industry must invest more in training to improve Canada's productivity performance and competitiveness. To influence the level of training activity, there may be a need for government intervention. Silviculture worker certification is one measure by which government can influence investments in their training.

The National Forest Strategy (CCFM 1992) recognizes the contribution silviculture workers can have in the development of Canada's forest resource. In particular, strategic direction item 6.5 has called for an assessment of the feasibility of a certification system for silviculture and forest workers in Canada, to increase worker mobility, safety, and skills. The purpose of this paper is to address the issue of worker certification by informing major forestry stakeholders on the theory and evidence surrounding certification, the merits and shortcomings of certification, and alternatives to certification.

Defining the Silviculture Worker

Silviculture workers may be defined by the work undertaken, and by their level of education and training (Williams 1970). According to the *Canadian Classification and Dictionary of Occupations* (EIC 1989), silviculture workers are defined in the following way: "A silviculture worker cultivates trees in support of long-term forestry programs directed toward regeneration of growth ... Prepares sites for reforestation by manually removing debris and unwanted vegetation ... Scatters seed of desired species of trees over areas prepared for new stands. Transplants seedlings from nursery ... Selects and cuts trees ... to improve stands of young trees and free best trees for faster growth ... Fights forest fires and protects against fire."

Silviculture workers are also defined within a broad category of education and training resembling a hierarchy of individual tasks, functions, training, and education (Sundberg and Silversides 1988). This hierarchy includes the following:

- *Professional* (generally university graduates)
- *Technical* (those who have undergone one or two years of formal full-time training)
- *Vocational* (skilled individuals who have undergone formal vocational training) and
- *Labor* (skilled workers who have either undergone worker training or acquired skill on job, and unskilled workers who have no vocational training or experience).

These educational and training levels are usually recognized and relate to the human resource requirements in most organizations (Sundberg and Silversides 1988). Silviculture workers are classified within the labor category because of their limited educational and training background within forestry and silviculture (Clarke 1986); however, these categories are not mutually exclusive. For example, a skilled forestry technician may be doing the work of a professional forester or a silviculture worker may be doing the job of a technician.

Training Concepts

The specification and nomenclature of training are worth highlighting.

Formal or informal training is a form of human resource investment.

Informal training can range from learning by doing, to observing others, or to being reprimanded for mistakes. "Self-instruction" is also informal training and the most underrated form of continuous learning. Informal training is often delivered as on-the-job training because it takes place during the production process and occurs incrementally over long periods of time; workers may not be aware they are undergoing a training process.

Formal training consists of "structured instruction" in the "how" and "why" of the job. Formal training can include formal demonstrations, basic classroom training, and vestibule training (a school organized in an industrial plant to train new workers in specific skills).

Training can also be general or specific. General training can be applied anywhere, not just in the firms that provide the training. Apprenticeship training is an example of general training where individual workers develop skills that would be of equal value both in the firm providing the training and elsewhere. Apprenticeship training takes place on-the-job and under the direction of a skilled worker. The marginal physical product of trainee labor increases by the same amount in the firm providing the training as it would in other enterprises. Training can consist of formal and informal instruction.

Specific training, however, is useful only in the company that provides the training. The distinction between general and specific training can sometimes be difficult to make. Training can contain elements of both. Moreover, training once deemed specific may be transferable to the production process of another firm.

Training costs and benefits are real. Generally, the costs include those of the trainee as well as of co-workers, supervisors, and instructors. There is also the cost of lost productivity during training or the loss of customers. Training benefits can assume lower production costs and increased productivity.

The market for formal training is explicit. Both employers and employees are able to purchase training from institutions, product manufacturers, or consulting groups. The quantity of training (hours, weeks, months) and price(s) are observable. Conversely, the market for informal training is implicit because training is largely influenced by the extent of supervisor and co-worker interrelations through orientation and monitoring.

Optimal Investments in Silviculture Training

A socially optimal investment in silviculture training is possible if certain conditions are satisfied. First, employers and employees have full information on the costs and benefits of training. Thus, there is no uncertainty about the future. Second, the training process does not involve any externalities. For example, there are no costs incurred or benefits gained by individuals or employers not directly implicated in the training exercise. Third, the labor market is (perfectly) competitive. Fourth, employers and employees have access to credit at market interest rates. Fifth, job mobility is such that employers are willing to provide training as long as the worker remains for long enough to ensure that the benefits of training are recovered by the employer (Gunderson and Riddell 1990).

Underinvestments in Silviculture Training

An underinvestment in silviculture training may result if these optimal conditions are not satisfied. This implies that wrong

decisions on human resource development are being made, but individual employers are probably making correct decisions about human resource development given the constraints they face (Gunderson and Riddell 1990). These constraints may lead to decisions that are optimal from an individual employer's perspective, but not necessarily optimal when summarized for the silviculture industry as a whole. An underinvestment in silviculture training may prevail for several reasons: externalities and poaching, inability to finance silviculture training, the job turnover paradox, and information problems. These constraints do not represent an exhaustive list; they merely point to central themes.

Externalities and Poaching

Training externalities may prevent the private market from producing a socially optimal investment in silviculture training. (Externalities arise when the cost of one agent affects the utility of consumers or production possibilities of producers for which they do not pay.) These externalities may arise because some silviculture contractors provide worker training that is easily transferable, and they cannot obtain full returns from their training investment because other contractors attract the trainees away by offering a wage premium. Contractors who lure trainees through wage premiums are said to be poachers. The poaching of trainees may cause those contractors giving the training to reduce their training initiatives or become very selective of candidates for silviculture training. A federal task force on Labour Market Development in the 1980s acknowledged the problem of externalities and poaching: "it frequently is highly uncertain that a particular private sector firm can appropriate the benefits from an investment in upgrading skills" (EIC 1981).

Inability to Finance Silviculture Training

The inability of employers and employees to pay for training may prevent the market from yielding a socially optimal investment in silviculture training. An employee's inability to pay for training may simply be associated with an inability to accept a lower wage during the training period, or to receive no wage because of an interruption in the normal work arrangement. An employer's inability to pay for training may be linked to constraints set by the contract tendering process and forest tenure system under which contractors operate. These constraints may influence employers to practice cost minimizing strategies, thus hindering their ability to finance silviculture training.

Most silviculture operations on Crown lands are tendered, meaning that the lowest bidder is usually awarded a silviculture contract. Cost minimization strategies by the silviculture contractor are important for securing contracts. One source has noted that the secret behind the low cost of contract work is the use of unskilled, underpaid, and even clandestine labor (Poschen 1991). Employing cost minimization strategies may leave little room to finance investments in human capital. If any training is given, much of it may be informal such as learning by doing, observing others, and being reprimanded for mistakes.

For those silviculture operations not tendered, but carried out by the principal authority responsible for forest management, another problem arises that can inhibit the provision of silviculture training. Most forest land in Canada is publicly owned,

and Pearse (1988) has observed that "the enthusiasm of Canadians for public ownership is not matched by an enthusiasm for big bureaucracies to manage them." This has led to the development of a Crown forest tenure system that provides individuals or companies with timber harvesting rights for varying periods in exchange for assuming various forest management responsibilities.

Because of the manner in which forest tenures have developed, Luckert and Haley (1990) noted there are "insufficient incentives for firms holding tenure to Crown land to carry out voluntary silvicultural operations because tenure holders frequently have no equity in the timber resulting from their investments and they perceive their tenure arrangements as insecure." Consequently, tenure holders are generally inclined to practice cost minimization strategies even when reimbursements on silvicultural operations are made. Exercising cost minimization strategies because of the characteristics of forest tenure systems may leave little in the way of financing investments in silviculture training.

Job Turnover Paradox

High job turnover rates associated with many silviculture activities such as tree planting may dissuade the private market from providing a socially optimal investment in silviculture training. It does not pay to train a workforce that may leave the silviculture industry or seek employment with other competing employers.

The movement of workers into and out of silviculture employment is characterized by labor accessions (the hiring or rehiring of workers) and labor separations (layoffs and quitting). Labor separations due to voluntary quitting are a significant factor in workers leaving the silviculture industry or seeking employment with other competing employers. The reasoning behind voluntary quitting can be complex, but some key factors are recognized. Silviculture is physically demanding and strenuous work which may push workers to quit. In addition, these workers may be quitting because of the lack of training that would enable them to manage the difficulties of silviculture work. Hence, a self-perpetuating problem develops: workers are not trained because of a high job turnover rate associated with voluntary quitting, and workers quit because they lack training to cope with the physically demanding nature of the occupation. Other factors may also contribute to the degree of voluntary quitting, including worker dissatisfaction with career opportunities, and wage differentials between silviculture and other sectors.

Information Problems

Inadequate information related to the supply and demand for silviculture training may cause the private market to fail to provide a socially optimal investment in training. In a perfect world, producers and consumers of training have full information on training goods and services offered and demanded. Everyone can therefore respond by producing what consumers want, thus leaving society better off. However, the real world operates quite differently. Limited information on training goods and services often prevails because of circumstances such as rapid technological change. It may be difficult to inform all consumers and producers on advances in technology.

In addition, workers and employers often have limited information on work-related risks to health and safety, and

often tend to underestimate risks. "If workers and firms are not fully cognizant of the job risks resulting from their decisions, the desirable properties usually imputed to market outcomes may not prevail" (Viscusi 1983). In other words, there would be little incentive to pursue training because limited information on health and safety risks could obscure the need for training.

Inadequate information could prevail because information exhibits the characteristics of "public goods": once the information about health and safety is available, it is not possible to exclude non-payers from using that information (Musgrave and Musgrave 1984). The provision of information is therefore limited because it is difficult to exclude non-payers from using it.

Evidence of Underinvestment in Training

Empirical evidence that there is an underinvestment in training depends upon the incidence of training. Training incidence is the proportion of employees receiving employer-based training and the percentage of employers providing training. Other indicators are also used, for example, private sector expenditures in training and the incidence of apprenticeships (Betcherman 1993a,b). Canada's investment in human resources suggests that Canadian firms formally train their workers less than other industrialized countries do. For example, in Japan (1989) 36.7% of all workers received some form of training, in France (1988) 26.6%, in Sweden (1987) 25.4%, in Great Britain (1989) 14.4%, in Germany (1989) 12.7%, and in the USA (1983) 11.8% (OECD 1991). In Canada, 11.3% of all workers reported receiving some form of training (Statistics Canada 1990).

Evidence on the incidence of silviculture training is derived from silviculture labor force studies completed in eastern Ontario, Newfoundland & Labrador, and Prince Edward Island (Rugo 1991, 1993a, 1993b). On average, 44% of all silviculture workers reported receiving silviculture training. Individually, stand tending workers had the highest incidence of silviculture training (average 71%) and nursery workers had the lowest incidence (average 27%).

These comparisons suggest training incidence is higher among silviculture workers than the Canadian average for all workers; however, some caution is warranted. Data on silviculture training are not readily available for other regions of Canada, particularly Quebec, Ontario, and British Columbia, which together represent the about 80% of the silviculture labor force. The training incidence shown by the three silviculture labor studies is not obvious in the rest of Canada.

An insight into the magnitude of silviculture training in other regions is found in several reports, namely *Human Resource Issues in the British Columbia Silviculture Industry* (SJAC 1988); *An Atlantic Forestry Vocational Training Program* (Corey 1989); *Report of the Ministerial Committee on Logging and Silviculture Sectors* (NBDL 1989); the AGFOR report, *Evaluation of Training Needs for the New Brunswick Forest Sector* (NBFPA 1989); and *Silviculture Training in Canada* (M. Butler, 1991, personal communication). Together these reports provide a description of the extent of silviculture worker training in Canada.

The silviculture industry in Atlantic Canada, employing about 12% of Canada's total silviculture labor force, shares common issues related to silviculture training. The New Brunswick report (NBDL 1989) concluded that many workers fail to obtain

training because they must forego unemployment insurance benefits. The need to bridge wages while on training suggests the inability of workers to finance silviculture training. The Corey (1989) report recommended establishing a training structure directed by industry and funded jointly by industry and government. Introducing a training structure highlights the concerns of externalities and poaching. The AGFOR (NBFPA 1989) report recommended a screening process to select motivated candidates for training. The underlying intent is to break the "job turnover paradox" that was alluded to as a reason for underinvesting in training.

The silviculture industry in Quebec and Ontario employs approximately 46% of Canada's silviculture labor force. Butler (1991, personal communication) found an inconsistent approach to silviculture training in Ontario. Training appears to be ad hoc in nature with a mixture of formal and informal training. In-house formal training programs exist for some major companies, but silviculture contractors undertake most of the silviculture work in the province. Most training, if offered, is informal, especially in tree planting. Contractors rely heavily on experienced crew leaders to provide the necessary on-the-job training. Contractors have attributed the low-key approach to training to the lack of available training programs and funding mechanisms for training.

In Quebec, silviculture training is geared more toward formal training, although informal training is widespread particularly in tree planting. Formal training programs such as "Sylviculture," "Aménagement de la forêt," and "Récolte de la matière ligneuse" are offered through the Quebec Ministry of Education at nine "Centres de formation en foresterie." Program funding is provided entirely by the Ministry of Education. In addition, these programs are offered to industry on demand and financed in part by industry and in part by contributions from Employment and Immigration Canada. Enrolments in some programs have been declining.

The silviculture industry in British Columbia is the largest in Canada, employing approximately 34% of the nation's silviculture labor force. The Silviculture Joint Adjustment Committee (SJAC 1988) found that many silviculture contractors offer some form of on-the-job training, but it is mostly informal. There is no clear indication of the number of workers who receive training. Silviculture contractors themselves admitted that their industry is subject to high job turnover rates fueled by voluntary quitting, and employers too frequently try to change the workers to fit the job. This suggests that worker training may be constrained because of the "job turnover paradox." The cost of training was also mentioned by contractors as a concern that blocks training.

The Silviculture Joint Adjustment Committee asked employers and employees about their exposure to silviculture training courses from private training schools and community colleges. They found that training from these outside sources was inadequate. Silviculture contractors surveyed stated only 10% of the such graduates were employed, and workers indicated that only 3% had received training. Contractors and workers believed that the training offered does not prepare workers for jobs in the industry. Informational problems associated with mismatching of training needs and program curriculum suggests an underinvestment in the right kind of training. In fact, it was suggested that industry be consulted in the development of training programs that tie their needs to program content.

Role of Government in Influencing Investments in Silviculture Training

The constraints faced by the silviculture industry may result in an underinvestment in silviculture training. Situations in which the actions of individuals do not conclude in an outcome that is optimal for society are generally referred to as market failures. This market failure, an allocational problem, provides a possible basis for government to intervene in the market and influence investments in training. Whether government intervention is merited, however, depends upon whether an imperfect government solution is better than an imperfect market solution (Gunderson and Riddell 1990). In other words, do the economic benefits resulting from government involvement exceed the economic cost when compared to a market solution?

Four policy tools could be used by government to influence the level of investments in silviculture training. They are intervention by taxation, subsidy, regulation, and the dissemination of information. A silviculture employer could be given a subsidy for training workers (maybe as a tax rebate), or taxed for not training workers (for example, 1% of payroll). Practically any tax measure can be paralleled by a subsidy. As a third option, employers can be compelled through regulation into training silviculture workers. The regulatory measure can require that all workers become certified as having a predetermined level of skill or ability to complete a silvicultural operation. The fourth option is to persuade the silviculture industry to train workers by providing them information on the supply and demand for silviculture training.

This discussion focuses on the regulatory policy option of silviculture worker certification. The other options are discussed later, in the section dealing with alternatives to certification.

Part 1: Theory and Evidence on Certification

1.1 Certification Defined

In any discussion about certification, definitions are a priori. For the purposes of this study certification can generally be defined as:

a process or act by which individuals are awarded educational credentials after successfully fulfilling a set of prescribed requirements at a certain educational level. Often it also acts as a guarantee that individuals have acquired a minimum set of qualifications for pursuing a particular profession or occupation, and/or for proceeding to the next stage of formal education (OECD 1977).

Certification implies both an act and a process. As an act it entails delivery of a certificate to an individual. As a process certification suggests both the awarding of a credential and the essential stages that lead to it: admission, grading, tracking, and examining (OECD 1977). The process is commonly referred to as "credentialing" or "formal selection." In actual operation, certification is not "stand alone": it often functions with different forms of institutional accreditation and licensing. Licensing can be viewed as an act or process by which candidates are screened for admission to a certain profession and accorded the legal right to practice that profession. Institutional accreditation is a process or act whereby a government department or specially constituted agency recognizes the standing of an educational institution in light of its ability to satisfy prescribed criteria (OECD 1977).

1.2 Certification: A Regulatory Measure

Certification serves to regulate the quality of training provided and ultimately the quality of labor employed. Therefore, it is a form of economic and social regulation: economic regulation as it applies to issues of product quality, and social regulation as it applies to issues of occupational health and safety (Reschenthaler 1979). Silviculture worker certification can be introduced through government intervention into the forestry sector; governments in Canada have frequently intervened in the management of forest resources because they are the stewards of public interest and owner-managers of the resource.

1.3 Functional and Dysfunctional Aspects of Certification

Certification serves to regulate the quality of education and training provided. It attests that the workers have received quality training, thus protecting them as consumers of education. Furthermore, it assures employers that they have received well trained workers, thus protecting the employers as consumers of economic inputs.

Equally, certification has several dysfunctions. Some claim that certification leads to the widening of the generation gap. For example, young workers benefit from formal training programs and receive credentials for the acquisition of skills not certified in the past. Often, the situation of older workers is exacerbated by the lack of ways to legitimize their knowledge and skills obtained outside the formal training system. Moreover, some contend that certification accentuates the phenomenon of attendance without motivation, because certification is perceived as essential to maintaining a job. Finally, others feel that certification leads to false employment hopes for graduates. Where the number of certifiable workers exceeds the number of jobs available, underemployment and frustration among workers may result from certification.

1.4 The Process of Certification

The process of certification includes defining the objectives of certification, determining the target groups to be certified, defining the certification and training standards, establishing a certification structure, and assessing the human resources employed in the silviculture industry.

1.4.1 Certification Goals

The goals of certification can include reducing occupational health and safety concerns, maintaining productivity, increasing product quality, reducing training costs, and sustaining a pool of well trained workers. Although these are sample objectives, they are not mutually exclusive and it is quite possible to have any combination of them. Furthermore, satisfying one objective may require the resolution of other closely related concerns. In the simplest form, worker certification amounts to answering the query: exactly what is the certificate holder expected to do?

1.4.2 Target Groups and Prerequisites

There are three levels to identifying the population to be certified. First, certification must serve those workers defined as "new entrants" and "veterans."

Second, certification must deal with silviculture workers as a global or disaggregated body, in the sense that there is no differentiation between those performing silvicultural activities

such as tree planting or thinning. Alternatively, workers can be addressed according to separate employment groups such as forest renewal, site preparation, stand tending, or nursery workers. Division of silviculture workers based on activity may lead to further choices, such as whether to certify all silviculture sub-employment groups (full certification) or merely some (partial certification).

Third, certification must contend with three labor force streams, termed "mainstream," "unemployment insurance induced," and "job creation." Mainstream workers are those who have entered the silviculture industry through regular job search. Unemployment insurance induced workers are those who continue in the silviculture industry long enough to qualify for unemployment benefits. Job creation workers are unemployed workers who receive employment opportunities to maintain their work skills while they are laid off, and who receive unemployment insurance benefits or enhanced benefits paid by Employment and Immigration Canada.

There may be prerequisites for entry into a silviculture worker certification program. To determine program suitability, candidates may be assessed against a set of entry requirements such as age, work history, experience, and level of formal education.

Entry requirements may be subject to provincial regulations, for example, age and education. In Canada, legislative provisions stipulate the age of 16 as the minimum legal working age. This translates into an educational attainment of grade 10.

1.4.3 Certification and Training Standards

The requirements underlying certification standards are based on three components: education, training, and experience. Establishing these standards is a long and laborious task necessitating the evaluation of all possible levels of education, training, and experience that will amount to a certifiable standard. Training standards reflecting consistency in the curriculum taught and the delivery of training are important considerations in a certification program. The success of a certification program is directly related to the competency of the people involved. The critical component of the training endeavor is the trainers (MFRS 1987). Training the trainers to be competent communicators and consistent when teaching students is a first step toward delivering effective training.

1.4.4 Certification Structures

A silviculture worker certification program can be structured on either a voluntary or a mandatory basis. In a voluntary program, silviculture employers and employees are free to choose if they wish to participate. Under a mandatory program employers and employees are required to participate.

Voluntary programs usually coexist with incentives that are used to entice participation. The incentives offered may be a bonus or a rebate. No policing is used to achieve compliance with the program, but monitoring activities may be performed to observe program effectiveness.

Mandatory programs usually function with some form of enforcement including the use of contract language, policy directives, and law. Some policing is carried out to ensure compliance, and monitoring activities may be used to observe program effectiveness.

1.4.5 Human Resource Assessment

Evaluating the education, training, and job experience

attained serves several purposes. It identifies gaps between the current quality of human resources in silviculture and the desired labor quality goal. Moreover, a human resource evaluation could serve to determine the costs and resources required to raise the current labor group to the certification level. Finally, the certification standards can be tested to determine whether they are realistic and obtainable goals.

Part 2: Merits and Shortcomings of Certification

What are the merits and shortcomings of having a certification program for silviculture workers? The merits of certification range from increasing product quality to reducing on-site injuries. The shortcomings of certification include transaction costs of certification, a phenomenon called the generation gap, and jurisdictional control. Granted that arguments for or against an issue are not always clear-cut, this can also be said about certification. Therefore, issues between the merits and shortcomings of certification are also included.

2.1 Merits of Worker Certification

2.1.1 Reducing Occupational Health and Safety Concerns

Silviculture work is characterized by natural and material risks to the health and safety of workers. The natural risks are related mainly to site and climatic conditions. Site conditions include steep and broken terrain, slash and other residue from logging operations, "chicots," hung-up trees, and "spring poles." Climatic conditions include rain, low or high temperatures that can lead to hypothermia or heat exhaustion, and strong winds. Material risks include dangers from operating chainsaws, spacing saws, tractors used in site preparation, pesticides, herbicides, and planting tools, to name a few.

Injuries resulting from natural and material risks are normally considered as the number of injuries occurring based on the number of workers at risk, expressed as the number of workers injured per 1000. Unfortunately, accurate information on the size of the silviculture labor force in Canada is not available to ascertain an accurate injury rate. However, information detailing the impact of injuries on person days lost and wage loss claims is available.

British Columbia and Alberta have detailed information on the occupational health and safety aspects of silviculture work which can provide a valuable example of the impact of silviculture worker injuries (Alberta Workers' Compensation Board, Edmonton, and British Columbia Workers' Compensation Board, Vancouver, personal communications). Wage loss claims and pension reserve costs (not including medical aid) incurred by the silviculture industry in Alberta and British Columbia are staggering. Between 1982 and 1991 approximately \$4.6 million dollars were paid out by the Workers' Compensation Board of British Columbia to tree planters whether employed by government, industry, or contractors. In addition, approximately 75 399 person days were lost because of work-related injuries. The costs incurred by the Alberta silviculture industry in terms of "lost-time claims" (wage loss claims) are also revealing. Over an 11-year period (1980-1991), approximately \$2.4 million dollars were paid out by the Workers' Compensation Board of Alberta. The total working time lost amounted to 11 749 person days.

There are several ways to reduce the frequency of accidents. According to a study on forestry accidents and prevention, "all

hazards should be eliminated at the source" (Patosaari 1983). Furthermore, if risks of injury cannot be eliminated from the source, then hazards should be reduced by technological measures, safety devices, training and information, organization, and personal protective equipment (Patosaari 1983). Although these preventive measures are important, worker training is crucial to the success of any occupational health and safety initiative. Worker certification can be used to induce preventative training and ensure that workers have received it and that employers are getting workers with the proper safety training.

From an economic standpoint, silviculture workers certified as having preventative training could reduce the overall number of accidents in silviculture and subsequently reduce the worker insurance rates payable by each employer to the relevant Workers' Compensation Board. Moreover, a reduction in the total number of injuries could reduce the amount of money spent on wage loss payouts and medical assistance. A decrease in the injury rate could decrease the productive time lost that would otherwise have been spent on silvicultural treatments in an already limited forest management season.

2.2 The Shortcomings of Worker Certification

2.2.1 Transaction Costs of Certification

The transaction costs of certification are the explicit and implicit costs incurred by society or the individual silviculture employer. Although the implications of transaction costs of certification pertain to the occupational health and safety concerns of silviculture work, similar points can be made on the issue of product quality, for instance concerning residual stand damage.

In the area of occupational health and safety, employers are not forced to realize the cost of using untrained silviculture labor in hazardous employment conditions. Because individual employers do not bear the full cost of their actions, most medical, rehabilitation, and income maintenance costs must be carried by society. In this instance, the individual silviculture employers become "free riders." According to one source, "neither the employer nor the employee is likely to absorb the full costs of individual injury and disease; the costs will be diffused through society" (Reschenthaler 1979). If the silviculture employer must realize the full social cost of occupational health and safety through regulatory means such as certification, what are the transaction costs associated with certification? More specifically, what are the implications of these costs?

The explicit transaction costs of certification are the costs of program development, worker training, program implementation, and monitoring activities. In a voluntary program there may be costs associated with the offering of financial incentives to lure program participation. Mandatory programs may incur costs associated with program enforcement.

The implicit transaction costs of certification concern the added labor costs above the wage rate, which may affect the ability of labor to substitute for other factors of production such as capital. In other words, the demand for labor could be affected. The total cost of labor wages plus the cost of human capital development from a certification program could make labor more expensive relative to other inputs such as capital. This could result in a decrease in the demand for labor and an increase in alternative inputs.

2.2.2 Jurisdictional Control

In Canada, legislative and ownership jurisdictions govern

the forest resource. Ownership jurisdiction is characterized by property rights and is a product of constitutional history. Legislative jurisdiction is characterized by the legislative authority over the forest resource and is a result of the provisions of the *British North America Act*, 1867, now reflected in the *Constitution Act* of 1982.

Section 92 (5) of the *British North America Act* gives the provinces legislative power over the management and sale of public land, interpreted as the forest resource. Provinces having exclusive rights over the management of public forest lands are faced with forest management problems and issues that are as diverse as the forest resource.

Individual provinces require a certain mixture of labor and capital to manage their forest resource. On the subject of labor, the quality and quantity of workers demanded reflect the long term forest and land-use management plan. This plan in turn considers the forest's age, species composition, and socio-economic demand pressures, to name a few factors. Provinces facing a diversity of forest resource issues would each adhere to a different mixture of silviculture labor components and different approaches to developing, implementing, and managing a certification program for silviculture workers. For example, Newfoundland and Labrador could stress stand tending workers as the major employment group requiring certification, whereas tree planting would be the major concern British Columbia. Although common ground can be found among provinces because they are all dealing with silviculture, some provinces may stress a full silviculture worker certification program and others may emphasize a partial certification program. This may lead to an asymmetric certification program that could create problems associated with labor mobility.

Provincial governments in Canada, beside holding jurisdictional control over their forest resource, also maintain jurisdiction over basic education, training, and certification. Thus, control over the development, implementation, and management of a silviculture worker certification program would reside with the provincial government. Broad provincial jurisdiction in the area of education, training, and certification means that the precise makeup and function of a national certification program can only be determined after extensive federal-provincial discussion and negotiation.

2.3 Between the Cracks of Certification

In some instances, certification is difficult to categorize in terms of merit or shortcoming. Certification has often meant that there are well defined characteristics typifying a particular job. The "implicit contract" is that certification leads to a good job. Specifically, the better the training, the better the certification, and the better the job. However, this implicit contract can become diluted during economic downturns. In a recession, certification or credentials do not guarantee good jobs, or any job, because labor demand is reduced.

In earlier times, certification was offered by trade and craft guilds charged with the duty to train new workers in an array of skills to serve society. Many of these skill relationships were set between craft guilds and the state. Today, similar relationships exist in the form of collective bargaining agreements between labor unions and industrial management. Certificates granting a certain degree of competence for specific occupations are usually recognized in such collective agreements. Certification, however, is not only achieved through industry and union rela-

tionships; separate educational institutions or training centres can also offer similar (in some case superior) credentials. Regardless, many graduates are barred from employment opportunity because they are not members of the existing union which controls the flow of new entrants.

Certification and credentials traditionally serve to eliminate control by a single player in the labor market; however, employment of new workers can also be curtailed if their certification is not recognized.

Part 3: Alternatives to Silviculture Worker Certification

Certification, a regulatory measure, is a form of government intervention to influence the level of investments in silviculture training. Other forms of intervention include taxation, subsidies, and the dissemination of information on training programs to employers and employees. Choosing a policy option that can influence the level of investment in silviculture training depends upon many interrelated factors such as the time frame for tangible results, and the cost/benefits of implementing one choice versus another.

3.1 Taxation

Tax mechanisms represent a classic solution to influencing investments in worker training. Tax-levy schemes have often been suggested as a solution to the poacher problem (Gunderson and Riddell 1990). Government intervention that supports training activities can be accomplished through a variety of tax measures, which can be either worker or firm based. Worker-based tax measures can include a severance pay tax exemption for training, registered education savings plan, and unemployment insurance provisions under Section 39, Fee Payer, of the *Canada Unemployment Insurance Act* (Stambook 1988). Firm-based tax measures include a levy-grant system, payroll tax credit, and training tax credit systems. Essentially, taxing employers for not training workers means that their endeavors become less profitable. The threat of a less-than-profitable operation acts as an incentive to train workers. Employers would approach worker training as a means of reducing their tax burden.

The shortcomings are twofold. First, incentives granting tax rebates for training have historically been too broad, "allowing for deductions from the cost of training activities of a dubious social value" (de Moura Castro and Cabral de Andrade 1990). Second, taxation methods tend to benefit large enterprises that are able to afford training in the first place. Smaller employers are usually forced to leave the industry, thus creating other concerns such as unemployment.

Examples supporting the use of tax mechanisms to induce investments in training are found in Germany, France, Japan, Ireland, and Sweden. Within these countries, companies are required to invest in the development of human resources through tax contributions organized under national training strategies (NCEE 1990). These tax contributions generally assume two forms. In Germany and Japan, companies contribute directly to government employment and training programs. The organization, management, or provision of basic and enhanced training is handled by the government. In Sweden, France, and Ireland, companies make tax contributions to a national training fund from which they can draw funds for approved training programs.

3.2 Subsidies

Rewarding employers for the successful employment of trained workers by subsidizing the training process could entice employers to engage in training activities. Employers could be reimbursed partially or totally for their training costs incurred, possibly through some form of tax rebate. Offering subsidies for training could solve the problem of market failure created by the "inability to finance silviculture training." An example where subsidies are used to encourage training is found in the State of California. There, if a trained worker gets a job and keeps it for at least 90 days, the training institution is reimbursed for the costs incurred (Steve Duscha, The structure of training in the United States: Toward a new model. No date; mimeographed).

A merit of offering subsidizing training is that it can steer employers away from practicing cost minimization strategies. Investments in training become affordable for both the employer and employee. A shortcoming of the subsidy approach is that training can become highly specialized and responsive only to the forms of training that are supported by subsidies. In effect, training can become less market oriented and may not reflect the real training needs of the industry.

3.3 Dissemination of Information

The dissemination of information on training programs is a possible role for government (Gunderson 1980), because inadequate information on the supply and demand for silviculture training may obscure the need for training and cause the private market to fail to provide a socially optimal amount of training. If employees and employers are not fully aware of training programs or cognizant of their benefits, they may not make decisions that minimize job risks or allow the selection of jobs and training strategies that promote outcomes improving health and safety. This also applies to other considerations such as worker productivity and product quality. Information exhibits the characteristics of public goods and therefore would require government to play a role in its dissemination. The government can play an effective role by informing the silviculture industry on the existence of training programs, training costs, and benefits of training.

Examples of successful dissemination of training information are found in Sweden. During the late 1970s and early 1980s, the forest industry in Sweden underwent an increased pace of mechanization (Pettersson and Aminoff 1982). Concerns were raised that increases in mechanization would lead to unacceptable levels of forest damage, but little attention was given to the issue. The only concern was to get as much wood out as possible at the lowest price (Froding 1991). In a 1980 study, the Swedish Department of Operational Efficiency reported an average stand damage frequency of 7.8% resulting from thinning operations. Some years later, a 1988/89 study reported an average stand damage frequency of 5.3%. Although this level was still above the 5% damage limit set by the Swedish Forestry Act, damages resulting from motor manual operations declined 60%, forwarding damages were reduced 36%, and loading damages over 80% (Froding 1991). A reduction in stand damage has been accredited to technological changes, and increased awareness, knowledge, and skills especially among machine operators (Froding 1991). The Swedish experience was a result of a dissemination of information by government on the problems facing the industry and the need for corrective action. The information supplied enabled those engaged in thinning

operations to make important decisions regarding technological innovations and training.

Another example where the dissemination of information has yielded positive results concerns a campaign by various public organizations in Sweden to enhance safety in forestry. Several organizations including Skogsarbeten (the Logging Research Foundation), the College of Forestry, and the National Board of Occupational Safety and Health carried out a comprehensive research and development project between 1976 and 1980 on the incidence and severity of accidents in forestry. These organizations worked closely with manufacturers, forest enterprises, and forestry employees. The working group studied production technology, protective clothing and equipment, wage forms, and the organization of safe work structures. Considerable importance was assigned to disseminating the results of the project. A massive program of dissemination was carried out including courses and training packages, conferences on safety in forestry, and popular publications. The frequency of accidents in forestry fell sharply during the 1970s as a result. Information from the study has been credited with improving protective clothing and equipment, safety courses at upper secondary schools, the employment of instructors at forestry enterprises, and the allocation of resources for R & D work aimed at resolving the problems of accidents.

Conclusion

In Canada, it is broadly held that there is a general underinvestment in training. This does not imply that wrong decisions on human resource development are persistently being made; rather, the silviculture industry is probably making correct decisions given the constraints they face. These constraints include externalities and poaching, inability to finance silviculture, job turnover paradox, and information problems.

A variety of policy tools can be used to influence training activity including taxation, subsidies, regulation, and the dissemination of information. Silviculture worker certification is a regulatory measure that can be used to influence investments in silviculture training. As noted earlier, the National Forest Strategy calls for an assessment of the feasibility of a certification system for silviculture and forest sector workers to increase worker mobility, safety, and skills. In the context of the implementation of this action item, an industry, labor, and government committee has been established. Individuals or groups interested in the work of this committee are encouraged to contact their provincial representative. In this regard, a contact list of provincial representatives on the committee is available.

A bibliography related to silviculture worker training is also available on request from the author, Canadian Forest Service, Natural Resources Canada, Hull, Quebec.

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