Article

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Woodsworkers and the Mechanization of the Pulpwood Logging Industry of Northern Ontario, 1950-1970

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During the 1950s and 1960s dramatic technological changes transformed the labour process in northern Ontario's pulpwood logging industry. In 1950 the most prevalent tree-cutting and skidding methods closely resembled logging techniques of a century before. Working outdoors in autumn and winter, men relied on their own muscles, aided by axes, handsaws, and horses to fell the trees, make the pulpwood logs, and skid them out of the bush. Throughout the next two decades, the managers of Ontario's large pulp and paper corporations strove to replace these simple tools and processes with machinery and ever more technologically sophisticated logging systems. Gasoline-powered chainsaws were substituted for hand-powered bucksaws, and operators with wheeled tractors known as "skidders" replaced teamsters and their horses. Along side these methods appeared wholly new logging systems relying on enormous hydraulic and diesel-powered tree harvesters and processors. All the year round, an equipment operator, sitting inside a temperature-regulated cab, manipulated the controls of a gigantic, self-propelled harvester that roared through the forest cutting all before it. With little exaggeration, one Ontario publication commented in 1964, "Today's mechanical operations are making the legendary feats of Paul Bunyan look like those performed by a 97 pound weakling."[1]

This sweeping technological transformation and its implications have yet to be studied by historians of technology and the labour process, although many industry commentators have scrutinized the innovations with an eye to reducing production costs and attracting a stable workforce. In 1966, one such analyst, C. Ross Silversides, Director of Woodlands Development at Abitibi Power and Paper Company Ltd., remarked at the World Forestry Congress in Madrid:

> With the introduction of increased mechanization into the logging industry there will be profound changes with regard to the labour force involved. The changes are of many kinds and will have far reaching effects. Karl Marx himself wrote "Social relations are closely bound up with production processes. In acquiring new productive processes, men change their mode of production and in changing their

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1. *Bush News*, July 1964.

> mode of production they change their ways of earning a living — they change all their social relations."[2]

Perhaps it is time for the historian to explore Silversides's — and Marx's — proposition with regard to Ontario's pulpwood logging industry, a primary industry of major importance to the economy of northern Ontario and a North American leader in the development of mechanical skidding and harvesting equipment.[3]

This paper will examine the process of technological change and its consequences for workers in the Ontario pulpwood logging industry during the 1950s and 60s. It will argue that a distinctive pattern of development emerged because the mechanization strategy of the pulp and paper corporations was shaped by the decisions and behaviour of workers and by physical factors such as the great variety of topography, terrain, and forest characteristics as well as the changing weather and seasons of the north. Throughout the period of rapid technological change, woodsworkers were not only greatly affected by management's mechanization strategy, but labour also played an active, although often unconscious, role in shaping that strategy. The paper studies first the process of mechanization, then its impact on the labour process, and finally the responses of woodsworkers to these changes.

THE PROCESS OF MECHANIZATION

In an important 1949 report, two authorities on the eastern Canadian logging industry concluded that "few companies have looked at the fundamental methods of pulpwood production with a questioning eye, and we must admit that our policy has not been toward long-range development of new methods."[4] To Ontario's woodlands managers this statement came as no surprise. For many years they had been noting uneasily that much logging technology, especially in the cutting and skidding phases, had remained

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2. C.R. Silversides, "The Influence of Mechanization on Harvesting and Transportation Methods", *Proceedings of the Sixth World Forestry Congress*, III (Madrid, 1966), p. 2804. Published reports on such matters as equipment developments, labour problems, and mechanization strategies written by woodlands managers and researchers hired by companies or industry organizations have provided a valuable source for this study. During the period under review, the Woodlands Section of the Canadian Pulp and Paper Association published more than 1,500 such reports as a service for member companies. Most reports cited here are available in the University of Toronto Faculty of Forestry Library.
3. On the importance of the industry to Ontario see Ontario, Department of Lands and Forests, *The Ontario Forest Industry: Its Direct and Indirect Contribution to the Economy* (Toronto, 1969); Ontario, Ministry of Natural Resources, Timber Sales Branch, *The Forest Industry in the Economy of Ontario* (Toronto, 1981). During the 1950s and 60s about one-fifth of Canadian logging activity took place in Ontario. On the Canadian forest industries see especially Canada, Royal Commission on Canada's Economic Prospects, Forestry Study Group, *The Outlook for the Canadian Forest Industries* (Ottawa, 1958); "The Logging Industry in Canada", *Labour Gazette*, 57:1 (January 1957), pp. 28-34.
4. B.J. McColl and W.A.E. Pepler, "The Status of Mechanization", Canadian Pulp and Paper Association (CPPA), Woodlands Section (WS), (Montreal, March 1949), Woodlands Section Index No. 1011. [Henceforth all Woodlands Section papers will be cited as WSI followed by the index number.]

stagnant despite the dizzying pace of technological change in most industries throughout the twentieth century. It may seem more surprising to observers outside the industry. After all, the giant pulp and paper companies which conducted most of the pulpwood logging operations in Ontario were leaders in establishing research departments to undertake sophisticated scientific and technical studies of pulp and paper making and they had enormous investments in elaborate machinery in their mills.[5] Since the industry's founding in northern Ontario at the turn of the century, pulp and paper making had been an excellent example of what David Noble has called "the modern science-based industry."[6] In their woodlands operations, however, the pulp and paper companies had invested little in research and development and little in equipment, relying instead on labour-intensive methods developed earlier by the traditional, family firms of the lumber industry. Here was an example of "combined and uneven development"[7] not only within an industry, but within the corporate enterprise itself.

Several factors account for the lack of technological innovation in the bush before the 1950s, the chief one being the abundance and cheapness of labour. Northern Ontario pulpwood logging was conducted on the basis of one hundred-man winter camps, in the tradition of the older lumbering operations of the Ottawa valley and the Georgian Bay district. Winter snow and frost conditions facilitated the transportation of timber from the stump to the river where spring freshets would later provide the high water for river drives. Moreover, large numbers of seasonal workers were usually available during the winters when activities in the agricultural, construction, and other industries were curtailed by winter weather. According to one 1940s study[8] based on the employment records of some twenty-five thousand men, only about 30 per cent of Ontario woodsworkers were "professional lumberjacks" who regarded logging as their chief or only occupation. Approximately 50 per cent were from farms — mainly marginal ones — and the remaining 20 per cent came from other industries such as building and highway construction where jobs were few in the winter months. About one-half of the logging labour force lived in Ontario, about one-quarter came in each year from Quebec, while the remainder came mainly from Manitoba and Saskatchewan. As long as this seasonal labour was abundant and relatively cheap,

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5. James Hull, "Scientific Research in the Canadian Pulp and Paper Industry", unpub. research paper, Graduate Programme in History, York University, 1982.
6. David Noble, *America by Design: Science, Technology and the Rise of Corporate Capitalism* (Oxford, 1977), p. 5.
7. Raphael Samuels, "Workshop of the World: Steam Power and Hand Technology in Mid-Victorian Britain", *History Workshop*, 3 (1977), pp. 6-72. On corporations and technology see Noble, *America by Design;* Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, 1977); Richard Edwards, *Contested Terrain: The Transformation of the Workplace in the Twentieth Century* (New York, 1979).
8. Archives of Ontario (OA), RG18, series B-109, box 6, "A Brief for Presentation to the Ontario Royal Commission on Forestry by Canadian Pulp and Paper Association on behalf of the Pulp and Paper Industry of Ontario", December 1946.

labour-intensive logging methods were the most cost effective, and woodlands managers had little incentive to introduce new technology.[9]

Occasional labour shortages had alerted management to the risks of labour-intensive methods and quickened the interest of some managers in mechanized methods. During the war-related labour shortage crisis of 1917-20, eastern Canadian woodlands managers formed the Woodlands Section of the Canadian Pulp and Paper Association with the purpose of pooling information about production problems and examining new, mechanized methods.[10] (Within the industry "eastern Canada" refers to Canada east of the Rockies.) Throughout the next three decades, the Section found ways to cut costs in the hauling and driving phases of logging by introducing track vehicles and trucks, but very little progress was made in felling and skidding where it seemed that equipment developed for other industries could not easily be adapted to the North. Ontario's small-diameter trees, mix of species, muskeg, swamps, rock, and rolling terrain prevented logging engineers, with relatively limited amounts of capital at their disposal, from finding effective alternatives to conventional methods as long as labour remained so cheap. Adapting the methods of the west coast logging industry, where the extremely rugged terrain and huge timber of British Columbia's coastal forests had forced lumbermen to develop mechanized methods almost from the industry's start in the nineteenth century, had not proven very successful. Neither had deploying farm tractors which were widely used in the less rugged logging regions of Europe and the southern United States.[11] One eastern Canadian executive's assessment of cutting machines in 1918 remained indicative of management's general approach for decades: "Give me two French Canadians in preference to any machine you can introduce."[12] Before the challenge of Ontario's varied physical environment could be met successfully by logging engineers, considerable outlays of capital would be required to develop cost-effective machinery suited to the province's boreal forests.

For many years before 1950, some woodlands managers, convinced that alternatives to labour-intensive methods should be found, had been urging top-level executives of the pulp and paper companies to allocate more funds for research and development in their woodlands divisions.[13] Executives were unwilling to commit much capital, preferring to rely on cheap, conventional logging methods. One reason for their reluctance, woodlands managers hinted, was the long-standing preference of top executives, who had almost all received their training in the mills, for allocating capital to mill developments rather than to the woodlands. The outdoor men

9. McColl and Pepler, "Status of Mechanization", pp. 151-3. Their point has been frequently repeated in reviews of past developments. See, for instance, G.E. Quaile, "Mechanization and the Forest Industry", *The Forestry Chronicle*, 41:4 (December 1965), pp. 397-9.
10. *Canada Lumberman*, 1 October 1918.
11. W.D. Bennett, "Cable Yarding Developments in Eastern Canada", WSI 1466, (April 1955); C.R. Silversides, "Use of Articulated Wheeled Tractors in Logging", *Unasylva*, 20:4 (1965), p. 2.
12. The comment, by Senator Edwards, is cited in *Canada Lumberman*, 1 October 1918.
13. G. Lemothe, "Woods Labour Problems", CPPA, WS, *Twelfth Annual Meeting: Papers and Proceedings* (January 1933); Alexander Koroleff, "Relationships between General, Woods, and Mill Management in Our Industry", WSI 234 (March 1934); Douglas Jones, "Co-operation", WSI 952 (June 1947).

continually pleaded their case for more funding before superiors who seemed to view woodlands departments as mere adjuncts, headed by men with practical woods experience and training in forestry, but limited financial or technical expertise. Woods managers were not in the same league as mill managers and had little hope of ever gaining the top level of power. This amounted to an internal structural constraint imposed on advocates of mechanization.

The long period of technological stagnation in cutting and skidding ended in the 1950s as a result of forces coming from several directions — the product market, the labour market, and the industry's suppliers. Product market pressures in the post-war period increased the need for mechanization. Woods managers in the late 1940s and early 1950s were confident that the demand for pulp and paper products would remain strong but that the Ontario industry would face stiffer competition which would require intensified efforts to keep costs low. Subsequent developments have borne out their beliefs. Since World War II Ontario mill capacity and output have doubled, and yet keen competition has reduced the Ontario industry's market share in the U.S. and western Canada.[14] The southern United States pulp and paper industry and the western Canadian industry have grown more rapidly, partly because natural advantages, such as larger diameter trees, higher density stands, and more favourable growing conditions, have permitted them to keep pulpwood production costs relatively low. Woodlands managers in Ontario pointed out that in order to compete with southern U.S. mills in long-held American markets south of the province, Ontario companies would have to find ways to reduce costs.[15] Since the southern industry enjoyed natural advantages and cheaper labour, it was impossible for Ontario operations to undercut the south's production costs with labour-intensive methods. The alternative was to increase productivity by mechanizing the production process.

The crisis in the labour market, however, was an even greater spur to mechanization. "There are definite indications," concluded a 1947 report, "that we are fast approaching the 'point of exhaustion' of labour supply — if it has not already been reached."[16] One reason for the labour shortage was the decline in the numbers of agriculturalists and other seasonal workers available for work in the logging camps. The neat dovetailing of labour requirements among seasonal industries had shown signs of breaking down for some years because of increasing rural depopulation. A 1950 study undertaken for the logging industry showed that the preceeding dozen years had seen an average annual net migration away from farms of fifty thousand, an important trend, given that 50 per cent of the annual pulpwood cut in Ontario had been made by agriculturalists.[17] As more men found permanent urban jobs, fewer were

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14. *Canada Year Book 1965* (Ottawa, 1966), p. 514; Hon. John Roberts, Sponsoring Minister, "Discussion Paper: A Forest Strategy for Canada", 30 September 1981, Tables 12 and 15.
15. Arthur S. Michell, "Mechanical Harvesting of Timber Crops", *Proceedings of the Royal Canadian Institute*, V:XI (1964), pp. 12-3; James G. Bowland, *Economic Indicators in Forestry and Forest-Based Industries in Canada 1961/69* (Ottawa 1971); W.S. Bromley, "U.S. Southern Forest Developments", WSI 2580, (August 1970).
16. R.S. Armitage, "Training of Woods Labour and Personnel", WSI 903, (January 1947).
17. David L. MacFarlane, cited by Alexander Koroleff, et al., *Stability as a Factor in Efficient Forest Management*, (Montreal, 1951), p. 52.

willing to offer their labour in remote bush camps where conditions and pay were poorer than in urban centres. Furthermore, managers believed that unemployment insurance benefits had lessened the incentive of some to find work during their winter off season. The industry was faced with a fundamental structural change in the labour market, one which promised a long-term and increasingly more acute labour shortage. Logging expert Alexander Koroleff concluded in 1951: "Mainly due to the increase in industrialization, the supply of transient labour, formerly very cheap and abundant during late fall and winter, has been shrinking, while its cost has been rapidly going up."[18]

As Koroleff's comment indicates, a dwindling labour supply meant rising woods wages. Koroleff used federal government statistics to confirm what operators already knew: wage rates in logging were climbing faster than in most Canadian industries. In 1941 weekly earnings of loggers were considerably below the average earnings of workers in Canada's eight major industries, but by 1951 loggers' wages on average were higher than those in all eight industries, with no indication that the trend would change.[19] Since labour costs represented more than 50 per cent of the total cost of pulpwood delivered at the mill, rapidly rising wages were adding substantially to production costs.[20] Companies operating in Ontario found the situation particularly acute. Woods wage costs were substantially higher than in the rest of eastern Canada, reflecting the pattern found in most industries. Moreover, unlike in most regions, Ontario bushworkers from 1946 onwards had an effective union that was able to take advantage of the labour shortage and drive up wage rates. Significantly, rising labour costs seemed to be threatening the competitiveness of the Ontario industry and ultimately the profits of the province's pulp and paper corporations, a situation which encouraged them to assume the leadership in finding labour-saving, cost-cutting, mechanized logging methods.

A tight labour supply also increased production costs because many workers would then "jump" from camp to camp in search of a better "chance" where forest conditions would permit higher piecework earnings. For decades, widespread jumping whenever jobs were plentiful had been labour's most effective form of protest and its best means of gaining better wages and living conditions. Jumping, which disrupted production and increased hiring costs, added substantially to the industry's already high labour turnover costs. Between 1943-44 and 1950-51, the average length of stay at a bush job in eastern Canada was 43.7 working days, and the trend was downwards.[21] Continuous recruiting was required by personnel departments. One study showed that

18. Koroleff, *Stability*, p. 2.
19. *Ibid.*, pp. 68-71. Koroleff's statistics are confirmed in Canada, Department of Labour, *Wage Rates and Hours of Labour in Canada*, No. 38 (Ottawa, 1955), pp. 14-5. For subsequent wage changes see *ibid.*, No. 43 (1960), p. 27 and *ibid.*, No. 53 (1970), p. 39.
20. CPPA, *The Pulpwood Harvest*, 4th edition, (Montreal, 1954), pp. 16-7. Although in eastern Canada labour shortages and higher woods labour costs were first experienced in Ontario, logging companies elsewhere eventually confronted such problems. The Technical Commission of the World Forestry Congress reported in 1966: "The scarcity and rising costs of labor are everywhere leading to efforts to reduce the cost of operations by mechanization and by economies of scale...." (*Proceedings*, vol. II, p. 2120.)
21. Koroleff, *Stability*, p. 15.

for every hundred men hired, "thirteen of the original 100 do not stay more than a week on the job, fifty do not complete one month's work...."[22] Koroleff believed that the "nomadic" nature of logging practically precluded the permanent settlement of woodsworkers. Most, he maintained, preferred jobs near their homes and found temporary, bachelor camps depressing because of the lack of "normal" amenities and the isolation from family life. Furthermore, because eastern Canadian logging largely depended on winter conditions, woodlands employment was highly seasonal, more so even than agriculture and construction. Since few men could find year-round jobs in logging, the more "steady and industrious strive to enter other, permanent occupations," and the pulpwood industry was left with a poorer-quality seasonal labour pool.[23]

The industry responded to a shrinking labour supply, rising wage costs, and high labour turnover rates with two strategies. First, management sought to bring down wage rates by increasing the available supply of labour. The industry pressured the federal government to direct prisoners of war, displaced persons, and new immigrants to logging camps. Woods managers found that retaining new immigrants in remote camps was nearly as difficult as retaining the Canadian-born. For instance, in the case of the 4370 displaced persons who were sent to Ontario logging camps, the industry lost some 72 per cent of them within one year, a drop-out rate far higher than that of similar persons in mining and farming.[24] At the same time, some companies tried to lure workers to their camps by providing more attractive living conditions – bunkhouses with two-man rooms, recreation facilities, and sports programmes. This strategy succeeded only to a limited degree.[25] Management's second and more promising strategy was to increase the productivity of existing employees by training workers in more efficient techniques, stabilizing the workforce, and developing new, mechanized logging systems.

22. W.A.E. Pepler, "Woods Labour in Eastern Canada", cited by Koroleff in *Stability*, p. 15. See also W.A.E. Pepler, "Labour Turnover in Our Pulpwood Camps", WSI 1013, (May 1949); M.S.M. Hamilton, "Study of Woods Labour Turnover", WSI 1287, (April 1953).
23. Koroleff, *Stability*, pp. 18-20. On seasonality amplitudes see George V. Haythorne, "Seasonality of Employment in Canada", *Labour Gazette*, 49:10 (October 1949), pp. 1210-6. The relationship between labour supply and mechanization has been thoughtfully explored by H.J. Habakkuk in his *American and British Technology in the Nineteenth Century: The Search for Labour-Saving Inventions* (Cambridge, 1962) and by Harry Jerome, *Mechanization in Industry* (New York, 1934). My emphasis on the importance of labour supply in the case of logging mechanization differs from the emphasis on management's bid for control stressed in the Canadian historical literature dealing with craftsmen. See Bryan D. Palmer, *A Culture in Conflict* (Montreal, 1979), ch. 3; Gregory S. Kealey, *Toronto Workers Respond to Industrial Capitalism, 1867-1892* (Toronto, 1980), chs. 3-6; and Craig Heron, "The Crisis of the Craftsmen: Hamilton's Metal Workers in the Early Twentieth Century", *Labour/Le Travailleur*, 6 (1980), pp. 7-48. See also Wallace Clement, *Hardrock Mining: Industrial Relations and Technological Changes at INCO* (Toronto, 1981).
24. O. Hall, "Displaced Persons in the Canadian Labour Force with Reference to Mining, Construction, and Pulp and Paper", (c. 1951) pp. 7-9. (Photocopy in author's possession.)
25. My thesis deals at length with efforts to increase labour supply by encouraging immigration and making improvements in living conditions.

During World War II, equipment shortages and the widespread use of training programmes in industry and the army had served to increase management's interest in employee training. In the past, woods skills had been learned on the woodlot of the family farm or in the *de facto* apprenticeship system of the camps. One woodlands manager later recalled that in the past

> the woodsworker was selected and trained by his father. More often than not the young fellow would start by piling with the pulphook the wood cut by his parent. Once this was mastered, he would progress to the axe and bucksaw, and if his father was one of those selected individuals who was given a horse when it came time to haul the wood the young man if he was a strong physical specimen — acted as a pulpwood loader.... The training system was built right into the production system, and to all intents and purposes, cost no money.[26]

During the 1940s the Woodlands Section began to argue that this worker-controlled form of training resulted in inefficient practices that might be eliminated if management assumed responsibility for training. In order to penetrate the bush-workers' knowledge of their trade, time and motion studies were conducted throughout eastern Canada. The results were analyzed to identify superior techniques, and substantial reports were published recommending particular logging methods and training courses.[27] Probably because the conventional worker-controlled training system was "economical and adequate,"[28] the new management-inspired programmes were neither widely implemented nor very effective. Management advocates of mechanization, however, knew that introducing mechanized equipment unfamiliar to workers would give management the opportunity to assume more control of training, to eliminate inefficient work habits, and to increase productiviy.

That productivity could be greatly increased by stabilizing the woodlands workforce was a major thesis of Koroleff's *Stability as a Factor in Efficient Forest Management*. According to Koroleff, providing year-round jobs and permitting permanent family homes near work sites would have ended the industry's unfortunate dependence on the "sailor type" of bush worker with his casual commitment to a job that was "not his principal occupation, nor even essential to his livelihood."[29] The permanent employee with a stronger attachment to his job would be less likely to "jump." Thus, one of management's aims in stabilizing the workforce was to reduce the bushworkers' most effective form of protest — voting with their feet. In order to provide permanent logging jobs and homes, the companies would have to discover

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26. C.D. Sewell, "Opening Remarks, Symposium on Manpower Requirements and Selection and Training", WSI 2342, (May 1965), pp. 1-2.
27. CPPA, WS, *Pulpwood Cutting: Efficiency of Technique*, (Montreal, 1941); ———, *Pulpwood Skidding with Horses: Efficiency of Technique*, (Montreal, 1943); ———, *Pulpwood Hauling with Horses and Sleighs: Efficiency of Technique*, (Montreal, 1943); ———, *River Drive of Pulpwood: Efficiency of Technique* (Montreal, 1946).
28. Sewell, "Opening Remarks".
29. Koroleff, *Stability*, p. 19. See also R.T. Carter, "A Stable Woods Labour Force", *The Forestry Chronicle*, 31:1 (March 1955), p. 23; on Quebec see Emile Gosselin *et al.*, *Factors Affecting the Stability of the Forest Labour Force*, (Quebec Forest Industries Association, 1957).

mechanized logging methods that would end the industry's dependence on winter conditions and build forest roads to facilitate access to work sites.

Attracting, training, and retaining labour would not solve all the industry's problems, for managers realized the logging industry was also faced with a declining supply of horses. Draught horses were integral to the eastern Canadian pulpwood logging industry which used some twenty thousand a year, many on a seasonal, contract basis. In 1951 it was reported that the horse population of Canada had been declining at the rate of about one hundred thousand a year since 1944, and the average age of logging horses was rising, with an estimated 13 per cent decline in horse productivity in less than a decade.[30] As the era of the work horse drew to a close, it was also becoming increasingly more difficult to find qualified teamsters and convenient supplies of harnesses, collars and other essential paraphernalia. Clearly a mechanical substitute was needed for the horse. Yet, no existing machine could compete with the horse's agility and flexibility in off-road bush conditions. Here was another spur towards new, mechanized methods.

Finally, the industry became more determined to gain greater control over its wood supply by minimizing its dependence on processes greatly affected by unpredictable and uncontrollable weather conditions. Unfavourable spring weather and run-off conditions could result in wood being "hung-up" before reaching the mill for an extra year, thus thoroughly disrupting the wood supply. Trucking pulpwood from the limits was regarded as a more reliable alternative to the drive. In addition, trucking would enable companies to reduce the costs of keeping huge inventories at the mill by maintaining a steady, year-round flow of wood from the limits to the mill.[31] This was an added incentive for finding year-round logging methods suited to a variety of logging conditions, including summer cutting and skidding in black spruce swamps which had defied conventional logging systems.

By the beginning of the 1950s, then, pressures, had built to such an extent that woodlands mechanization, so long delayed, finally became a priority of pulp and paper companies. The process of mechanization that took place was partly the result of management's deliberate strategy and partly the result of new equipment developed outside the pulpwood logging industry.

The formal strategy of the industry was articulated and implemented by the Woodlands Section of the Canadian Pulp and Paper Association. In 1948 the Section set up various committees to promote mechanization, and that summer the first

30. Koroleff, *Stability*, pp. 54-7; B.J. McColl, "Problems in Mechanical Hauling from the Stump", *Woodlands Review*, (January, 1951); University of Toronto Archives (UTA), A.S. Michell Papers, A.S. Michell, "The Canadian Horse Population", paper prepared for Kimberly Clark, Longlac, 4 September 1958.

31. I.F. Fogh, "Mechanical Logging", WSI 938; A.S. Michell, "Trends and New Developments in the Transportation of Wood in Eastern Canada", *The Forestry Chronicle*, 29:4 (December 1953); Mechanical Harvesting Committee, "Report on Truck Problem Survey", WSI 1825 (1958). J.P. Curran places a great deal of emphasis on the shift to trucking in explaining mechanization in Newfoundland. See his "The Process of Mechanization in the Forest Industries of Newfoundland", (M.A. thesis, Memorial University of Newfoundland, 1971).

annual outdoor mechanical hauling meeting was held, at which attention was drawn to the acute need for mechanization at the stump and in the skidding phase.[32] Koroleff's *Stability as a Factor in Efficient Forest Management* thoroughly documented the case for mechanization. In 1949, W.A.E. Pepler and B.J. McColl, chief researchers for the Woodlands Section, presented an imaginative report that called for a re-conceptualization of logging along the lines of tree-length and full-tree methods, so that more steps could be performed under more controlled conditions at central points. It suggested developing multi-operation processing equipment that would perform several functions such as bucking, limbing, debarking, etc. Even more important was Pepler and McColl's equipment development project begun in the early 50s under the auspices of the Woodlands Mechanization Committee, using funds from a special assessment of participating companies.[33] This proved to be the most complete expression of inter-company co-operation in the mechanization field.

Well before these industry-sponsored programmes began to bear fruit, however, a major technological advance brought about by external developments had overtaken the industry. In the early 1950s, gasoline-powered chainsaws found widespread acceptance among Ontario bushworkers. It had taken many, many years of refinement before chainsaws were available that proved practical in Ontario's bush. The first U.S. chainsaw patent had been issued nearly a century earlier, in 1858, and gasoline-powered chainsaws had been developed by 1905.[34] In the late 1920s a Woodlands Section study of power cutting tools reported that German-made gasoline chainsaws, which had been tried out on a number of Canadian operations, seemed to be the most promising cutting tool although they could not yet compete with the bucksaw in Ontario's small timber since they were awkward, weighed some 140 pounds, and required two men to operate them.[35] It was not until after World War II that the technologies of light metals and of air-cooled engines enabled several equipment manufacturers to offer more practical chainsaws, although even these had serious "bugs" at first. Nevertheless, the chainsaw producers and their sales representatives found a lucrative market in the north, as some companies and many pieceworkers purchased the new saws in order to improve productivity. In 1952 the Woodlands Section Cutting Tools Committee reported increases in productivity of some 15 to 20 per cent and concluded "the light one-man power saw is here to stay. It is providing more satisfied workmen, better production, and higher earnings."[36] Woods managers and workers alike seemed pleased with this windfall development. By 1955 scarcely a bucksaw was in use in the pulpwood forests of Ontario.

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32. "Report of the Mechanical Hauling Field Meeting", WSI 1116, (October 1950).
33. McColl and Pepler, "Status of Mechanization"; _____, "The Development of Mechanical Pulpwood Logging Methods for Eastern Canada", WSI 1325, (July 1953); CPPA, *Annual Report*, 1957, p. 17; Silversides, "Achievements and Failures", WSI 2619, (February 1972).
34. Ellis Lucia, "A Lesson from Nature: Joe Cox and His Revolutionary Saw Chain", *Journal of Forest History*, 25:3 (July, 1981), pp. 159-61.
35. A. Koroleff, "Portable Motor Saws and their Applicability to Cutting Pulpwood in Canada", in CPPA, WS, *Twelfth Annual Meeting: Papers and Proceedings* (Montreal, 1930), pp. 69-82.
36. T.M. Pond, "Report of the Cutting Tool Committee", App. C, WSI 1274, (October, 1952).

The speeding up of the cutting and bucking phase created a new bottleneck in hot logging operations -- teamsters and horses could not keep pace with the cutters. Here was another incentive, in addition to the teamster and horse shortages, for finding a substitute for the horse. The pattern of mechanization in this phase at first resembled the indirect development of a substitute technology in cutting. Equipment manufacturers began producing wheeled skidders in the mid-1950s. The first in Canada, introduced in 1954 at the Ontario logging operations of KVP, was simply a stripped-down, four-wheel drive truck with conventional steering.[37] Machines of this type, such as the popular Blue Ox, manufactured by the Four-Wheel Drive Auto Company of Clintonville, Wisconsin and Kitchener, Ontario, found a ready market in Ontario because the shortage of horses and teamsters had become so acute. Wheeled skidders, power saws, and other changes contributed towards a productivity increase in pulpwood logging of some 45 per cent during the 1950s.[38] Nevertheless, the wheeled skidders of the 1950s, which had not been designed specifically for Ontario conditions, were not a complete success since they frequently broke down, became mired in muskeg, and had difficulty manoeuvering in dense brush.[39] Equipment manufacturers had thus provided only a stop-gap alternative to the horse.

The breakthrough in the wheeled skidder came from the Woodlands Section's own equipment development project. Since 1950 the Mechanization Committee had directed its attention to designing a skidding vehicle specifically for eastern Canadian pulpwood logging. The result was the Bonnard Logger Mark IV of 1956, a wheeled skidder with an articulated frame for manoeuverability and huge tires for traction and floatation -- potentially a highly efficient vehicle in off-road forest conditions.[40] In field trials, however, the new machine "had a disappointing habit of falling apart."[41] Having contributed a total of $250,000 to the project, members voted to abandon it and leave the field of machine design to equipment manufacturers. The Bonnard Logger patents were sold to Clark Equipment of Benton, Michigan, which modified the design and produced the Michigan Pulpwood Logger 75 for the market. This vehicle soon proved to be a failure and Clark lost interest in the project. Nevertheless, inspired by the articulated concept and the apparent interest of the Canadian pulpwood industry, a few equipment manufacturers in Canada began developing their own articulated wheeled skidders in the early 1960s. The most successful was the Timberjack, designed and manufactured by a Canadian firm in Woodstock, Ontario.

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37. J.R. Mackay, "Wheeled Tractor Skidding of Tree Lengths", *Woodlands Review*, (August, 1956).
38. Duncan R. Campbell and Edward B. Power, *Manpower Implications of Prospective Technological Changes in the Eastern Canadian Pulpwood Logging Industry*, (Ottawa, 1966), p. 57.
39. L.R. Scheult, "The Use of Small Tractors in Logging", WSI 2000 (August, 1960).
40. Jean A. Berrard, "Articulated Wheeled Skidders in Canada, 1961-66", *Woodlands Review*, (November, 1967).
41. Gordon Godwin, " 'The Beginning of a Beginning' ", WSI 2479, (July 1968).

Sales were brisk: the number of articulated skidders in use in eastern Canada increased from sixty-two in 1960 to 2160 in 1965 and 3550 in 1969.[42]

"Paul Bunyan's famous legendary blue ox, Babe, has lost his job to a wheeled skidder," was one journalist's description in 1963 of the transition that had taken place.[43] It would be more accurate, if less colourful, to say that the astonishing success of this manoeuverable and reliable machine enabled pulp and paper companies to increase productivity and overcome horse shortages. Many would mourn the passing of the "romance and serenity" of the horse era. "We hate to see the horse go," remarked a Spruce Falls supervisor in 1966 as the company eliminated its last horse. "But they are outdated. They represent a productivity factor that is just too low for us."[44] Wheeled skidders could forward far larger and heavier loads and maintain off-road speeds of six miles per hour.

Although woodlands managers seemed confident that production per man-day was increasing as a result of wheeled skidders, measuring their precise impact is impossible since other managerial and mechanical developments were occurring at the same time. Partly because of the greater capacity of the skidders, some companies turned from short-wood systems, in which bucking, piling and scaling were performed near the stump, to tree-length and full-tree logging, where most of the processing took place under the more controlled conditions of a roadside landing.[45] Processing equipment that could not be taken into stump areas was sometimes deployed at roadside landings. Some operations introduced high-powered mechanical slashers which bucked the logs into required lengths; some purchased mechanized loaders for loading logs onto trucks; some used mechanical chippers to convert whole trees into chips that were blown into large containers for truck transport. A variety of combinations appeared as woods managers assessed the relative costs of machinery and labour as well as the availability of workers for each logging site. All these cut-and-skid methods offered considerable flexibility in meeting local conditions. The new equipment, as well as managerial changes aimed at improving the output of workers, resulted in a 45 per cent increase in the amount of wood cut by production workers per man-hour between 1954-55 and 1964-65.[46] Meantime, labour costs per unit of output

42. *Ibid.*; Silversides, "Achievements and Failures"; J.R. Hughes, "Logging Operations in Canada — Review and Forecast", WSI 2553, (April, 1970). On the success of Canadian-made skidders in the world market see Mechanical Transport Branch, Industry Trade and Commerce, *Mechanization in the Forest: Benefits and Opportunities* (Ottawa, 1972), p. 27.
43. James Y. Nicol, "The Tree that Saved a Town", *Canadian Weekly*, (25-31 January 1964).
44. John Pringle of Spruce Falls quoted in *Ontario Logger*, (February 1966). See also UTA, Michell Papers, A.S. Michell, "Cost Analysis of the Small Skidding Tractor", for Kimberly Clark, Longlac, 24 August 1959; H.H. Bert Styffe, "Whither Romance?", *Log Book*, (July-August 1962).
45. Douglas D. Hamilton, "Full tree logging methods and machinery", *Pulp and Paper Canada*, (May, 1980).
46. Hughes, "Logging Operations". On productivity and problems in measuring it, see Forestry Study Group, *The Outlook*, pp. 151-4; Campbell and Power, *Manpower Implications*, pp. 17-22, who note that Ontario by the mid-1960s had achieved a lower labour cost per cord than the rest of eastern Canada despite the fact that labour costs per hour were about 40 per cent more than the eastern Canadian average.

were kept from rising rapidly. For the eastern Canadian industry, wood costs as a proportion of total pulp and paper costs decreased from 31 per cent in 1945 to 26 per cent in 1965, a fact Ontario Paper Company's Gordon Godwin suggested each woods manager should proudly point out to his president the next time the manager was squeezed through "the corporate wringer."[47]

At the same time as this single-purpose technology was being developed, advances were being made in the direction of multi-processing equipment intended to revolutionize existing methods, greatly reducing the amount of handling and the number of workers required. Although the Woodlands Section promoted the idea, reporting on similar developments elsewhere — in the southern U.S., British Columbia, and the Soviet Union — the co-operative approach that had succeeded in developing the articulated skidder was not repeated in the case of "fully-mechanized" harvesting systems.[48] Instead, several equipment manufacturers, finally convinced that the pulp and paper companies were serious about investing good money in machines, began their own programmes, sometimes benefitting from the advice of a pulp and paper company which would test the equipment. In other instances, pulp and paper companies sought to gain advantages over their competitors by secretly developing new machines on their own or in partnership with other pulp and paper firms. The risks of failure proved high whatever the approach.

Equipment designers tried a number of strategies. In 1958 Quebec North Shore Paper Company introduced its Vit Feller-Buncher. This crawler-track vehicle, operated by one man, approached a tree, felled it with a hydraulically-driven chainsaw and then bunched the tree-lengths which were later delimbed and slashed by a Bombardier Processing Unit. "Both machines were ingenious in concept and both became museum pieces in two years," remarked one Woodlands executive, adding, however, "they pointed the way to improved design."[49] In 1959 the staff of American Can Corporation of Canada developed plans for what became the Beloit Tree Harvester, a thirty-ton crawler vehicle that grappled a tree, limbed and topped it using the tree as its standing support, and then sheared it, thereby creating a tree-length log in fifty seconds. It proved more successful and Beloit, a long-time manufacturer of pulping and paper mill equipment manufactured many of these harvesters during the 60s. However, it could not operate efficiently where slopes were greater than fifteen degrees, and soil conditions in many parts of Ontario would not support a thirty-ton vehicle. In 1962, Logging Research Associates, a joint venture of Canadian International Paper Company, St. Anne Paper, and Quebec North Shore Paper, announced the development of a full-tree logging system. One relatively light and versatile machine sheared and skidded the trees to the road side where an Abromatik processor topped, limbed, barked, and slashed them by means of a telescopic, forty-foot grapple arm that fed the tree-lengths through a series of rollers and blades. In 1967 Spruce Falls Power and Paper and Timberjack Machines developed a

47. Godwin, " 'The Beginning' ".
48. For a list of papers on "Foreign and Regional Logging" see CPPA, WS, *Classified List and Index of Publications* (December 1968), B-1-2, pp. 1-3.
49. Godwin, "The Impact of Modern Technology", p. 448.

harvester with excellent floatation designed to travel over the peat of the clay belt of northern Ontario and rapidly fell and forward its small-diameter trees.[50]

Throughout the 1960s, some of these systems were discarded and others refined. Brilliant engineers developed numerous prototypes, but pulp and paper companies proved even more hesitant than equipment manufacturers to commit the huge amounts of capital necessary for turning a prototype into a production model.[51] By 1970 the partnership of Koehring, a Milwaukee-based construction equipment firm, and Watrous, a manufacturer of pulping equipment, had developed one of the most promising systems, the Koehring Short-Wood Harvester, a $133,000, ninety-five thousand pound machine designed to shear, top, limb, buck and accumulate eight-foot pulpwood. Highly manoeuverable because of its centre-articulated frame, it also could be highly productive given Ontario's low-diameter trees because it needed to pick up each tree only once and it could grapple and shear several small-diameter trees simultaneously, then pass them on to an automatic limbing and bucking component, finally stuffing the logs through a spring-loaded gate into a cradle at the rear of the vehicle. In 1970 it represented the state of the art in tree harvesting and seemed to promise a proliferation of fully-mechanized systems.[52]

All the new harvesters, however, had several drawbacks that severely limited their use and led to deep disillusionment within the industry. The harvesters were often too heavy to travel on muskeg and difficult or impossible to manoeuvre in rugged country; they caused considerable silvicultural damage by destroying young trees and digging deep ruts that upset natural drainage patterns.[53] In a 1971 report the Woodlands Section Logging Operations Group expressed the industry's disappointment with the harvesters, predicting that further mechanization would be hard because of "physical difficulties" resulting from "terrain and stand factors". Even more crucial, according to the Group report, was the failure "to reach full utilization of the existing equipment" because of problems of equipment maintenance and abuse. The multi-purpose harvesters required many recently-developed parts, each subject to breakdowns.

50. G.E. Cross et al., "Fundamentals of Mechanical Logging: A Symposium", WSI 2337, (May 1965); R. Rauzenhafer, "The Abromatik System", *Woodlands Review*, (November 1967); Michell, "Mechanical Harvesting", pp. 12-6; Godwin, "The Impact", pp. 447-50; G.W. Bell, "The Timberjack — Spruce Falls Small Tree Harvester", WSI 2583, (November 1970).
51. C.R. Silversides interviewed by author, June 1982.
52. W.R. Beatty, "The Koehring KHIIIB Harvester", WSI 2592, (October 1970); S.A. Axelsson, *Repair Statistics and Performance on New Logging Machines: Koehring Short-Wood Harvester*, Pulp and Paper Research Institute of Canada [PPRIC] Report No. 47, (Montreal, 1972). Capital flows into machinery and equipment in the Canadian forestry sector indicate the shift towards capital intensive logging. In 1961 dollars, annual investments before 1945 never exceeded $37.1 million; by 1960 they totalled $125.8 million, and by 1970 $202.0 million. (Statistics Canada, *Fixed Capital Flows and Stocks, 1926-1973* [Ottawa 1974], p. 121).
53. J.F. Fowler, "Mechanical Logging and Its Impact on Forest Management", *Your Forests*, 3:3 (Winter 1970), pp. 11-4; C.R. Silversides, "Progress and Problems in the Mechanization of Forest Work in Relation to Modern Silvicultural Techniques", *Proceedings of the Seventh World Congress of Forestry* (Buenos Aires, 1972), p. 967; George Weetman, "Forest Mechanization and the Environment", in C.R. Silversides, ed., *Forest Harvesting, Mechanization and Automation*, (Ottawa, 1974).

Because of the interdependence of components in these complex machines, a breakdown in one component often meant the failure of the total system and a complete halt to production. The new harvesters thus threatened the main objective of every woodlands department — to provide a steady supply of wood for the company mills. A "period of cold appraisal" was necessary so that the industry could digest the results of the sweeping changes, changes that also had required a drastic re-organization of the labour process and new methods of training, disciplining, and motivating woodsworkers.

THE LABOUR PROCESS

In their mills, Ontario pulp and paper companies since the industry's founding had carefully planned the labour process and introduced the most up-to-date management techniques in order to maximize production from their expensive pulping and paper-making equipment. In their logging operations before 1950 companies used methods which were, as critics put it, "primitive."

Before the coming of mechanization, bush jobs entailed much heavy work which was often made more unpleasant and arduous by exposure to bad weather. The pulp cutter's working day usually began before dawn with a long walk from the bunkhouse to the cutting site. After the strip boss assigned the cutter a strip of timber about sixty-six feet by 660 feet, the feller had to "swamp" a trail down the middle of his strip, clearing the underbrush and removing all the timber, snags and windfall that might later impede skidding out the logs. The pulp cutter then planned his cut making certain the trees fell in a pattern that would permit rapid piling and skidding. It was heavy work. After determining where he wanted the trees to fall, the cutter made a notch with several hefty swings of his two-and-a-half pound axe. Next, he made the backcut with his bucksaw by bending double from the waist, hooking his body around the tree, and sawing towards himself with his saw just above the ground — a back-breaking task. The tree was then pushed down by exerting one's self "to the limit." Most cutters then limbed the tree with an axe and bucked it into log lengths with a bucksaw. Toward the end of the day, the cutter piled the day's cut in neat piles which could later be scaled and eventually skidded to the roadside. According to a 1941 survey of cutters, piling was the most exhausting work of all. A supervisor of logging at Stevens, Ontario in 1948 maintained that "it is the bullwork of piling that turns most men away from this type of work."[54]

54. Armand Legault, "Logging Operations Group Report — 1970", WSI 2596, (September 1971). See also Silversides, "Achievements and Failures"; Mechanical Transport Branch, "Mechanization in the Forest", pp. 33-4. CPPA, WS, *Pulpwood Cutting*, p. 17; UTA, Michell Papers, Lloyd M. Lein, "Mechanical Logging Operations as carried out at Marathon Paper Mills of Canada, Stevens, Ontario", for Marathon Paper, 26 June 1948. On cutting techniques see CPPA, WS, *Pulpwood Cutting*; Nelson Courtland Brown, *Logging: The Principles and Methods of Harvesting Timber in the United States and Canada*, (New York, 1949); A.E. Wackerman, W.D. Hagenstein, and A.S. Michell, *Harvesting Timber Crops*, 2nd ed., (New York, 1966). For discussions by historians see A.R.M. Lower, *North American Assault on the Canadian Forest*, (Toronto, 1938); Donald MacKay, *The Lumberjacks*, (Toronto, 1978) and Graeme Wynn, *Timber Colony*, (Toronto, 1981).

This heavy work was made much more disagreeable by soaking autumn rains, bogs and endless days of sub-zero temperatures and howling Arctic winds. Once the woodsworker started to sweat, it was dangerous to rest in freezing temperatures. Plodding through deep snow was not only wet and cold, but it also took far more energy and slowed cutters down. In comparison with working on dry ground, it took 25 per cent longer to fell in two feet of snow and 50 per cent longer in three feet.[55]

Cutting was very dangerous. Fellers manipulated sharp cutting tools with their own hands, often when standing on icy ground that prevented sure footings. Protective clothing was shunned by pieceworkers who believed it slowed them down. Each year dozens of cutters were maimed by falling timber. Piecework increased the dangers, for many toiled near the point of collapse and at a frantic pace, thus exposing themselves to additional hazards. Logging had the highest number of serious accidents per worker of any Ontario industry. Wood employers paid the highest level of compensation under the Workmen's Compensation Act, a fact that encouraged woods managers to find safer logging methods that would separate the worker from dangers.[56]

The arduousness and dangers of logging partly explain the declining numbers of men willing to work in the bush after World War II. Yet, for many, traditional logging had an appeal that drove men to work astonishingly hard and risk their lives as well. Why? Were they masochists? Certainly the machismo image had long been part of logging, and some did thrive on the tough, dangerous jobs. For others, the wilderness had an appeal, and in their minds, perhaps, logging was not far removed from hunting, fishing and other forms of wilderness recreation they enjoyed. Overwhelmingly, men were attracted to logging because it offered an opportunity to make some "fast money" in a few weeks or months during the wintertime. Two factors related to the labour process also help to explain the appeal of logging: the skills demanded by the job and the independence of the work.

In sharp contrast to factory work, where tasks were often repeated year in and year out, bush work was extremely varied. There was a distinct seasonal rhythm to logging: camp and road construction took place in late summer, felling from early fall until about New Year's, skidding soon after the first snowfalls, sleigh hauling when the snow became deep, while river driving had to wait for the spring freshets. Few employees worked on every phase of logging, but those who did always knew that the nature of their job would change before long.

The work of logging was also varied — and made more demanding — by the ever-changing natural conditions. Each strip presented a unique combination of topographical and terrain factors that required adjustments and judgement on the part of workers. The best fellers carefully planned the cut, determining the direction trees should fall in order to economize on effort, facilitate subsequent steps, and ensure safety. Adjustments in felling procedures were needed to allow for bowed trunks, fire scars, uneven tops, gusting winds, and so forth. *Globe and Mail* journalist Arthur Cole

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55. CPPA, WS, *Pulpwood Skidding*, p. 32.
56. See the annual *Statistical Report* of the Workmen's Compensation Board of Ontario, 1947-1970; Pepler and McColl, "The Development", p. 11.

described the skills of the cutters he saw at an Abitibi camp northeast of Iroquois Falls in 1947:

> A real artist minimizes the heavy labour for himself by dropping the trees within inches of where he wants them. And that is no mean trick, any novice of the game will find. By dropping the tree mid-way across his skid-pile, the real artist can cut into lengths, strip the branches and pile neatly with little more than a twist of the wrists or the leverage afforded by a handy pike pole.[57]

A good teamster was equally skilled. He knew how to select the best location for trails in order to avoid zigzagging, rambling, and steep slopes. He sensed when to rest his horse and knew the appropriate load size given the ground conditions.

Managers took for granted the skills of the bush worker until the number of rural people with woods skills began to decline. Confronted by a dwindling supply of seasonal labour, Koroleff stressed in 1951:

> The concept that logging is a repetitive, routine work, requiring a 'strong back' and but little thinking, is decidedly incorrect. For efficient performance, much intelligent thought is necessary in logging due to changing combinations of many pertinent variables.[58]

In addition, woodlands managers came to realize that only practice and skill could make an efficient axeman, sawyer and teamster. Axe work and sawing required accuracy and rhythm to maximize productivity. The teamster had to develop a special understanding with his horse since the best results were obtained with "a few softly-spoken commands," whereas using reins reduced control, and beating had far worse results.[59]

Many men of rural background had little education and few skills suited to urban jobs, but in the logging camps they could put to good use their knowledge learned on the far woodlot. The work thus appealed to them, and they took great pride in their skills. In this, they resembled craftsmen, although a more apt analogy might be the mine worker who also gained little recognition for the skills he possessed when undertaking his dangerous and strenuous work.

Workers were also attracted to logging by the independence of the work and, closely related, the piecework earnings. On cut-and-pile operations, the cutter worked his own strip, isolated from his fellow workers and from his supervisor throughout most of the day. Only rarely did the strip boss pay a visit to the piecework cutters who were dispersed throughout the woods. The piece-rate system served as an invisible foreman, making close supervision unnecessary. On the other hand, the supervision which was exercised by the camp boss was usually of the bullying variety; tough bosses were meant to ensure an overall discipline within the camp.[60] On the job, the worker

57. Arthur Cole, "Abitibi Tree Cutters Real Artists", *Globe and Mail*, (Toronto), 4 February 1947.
58. Koroleff, *Stability*, p. 57.
59. CPPA, WS, *Pulpwood Skidding*, p. 67.
60. This ambiguity resembles what Wallace Clement has found in the mining industry. See his "The Subordination of Labour in Canadian Mining", *Labour/Le Travailleur*, 5 (Spring 1980), p. 141.

enjoyed a great deal of autonomy that gave a sharply individualistic thrust to the pulpcutter. He planned the cut on his strip, organizing the work in his own way. He set his own pace, taking breaks when he pleased — or when he felt he could afford to do so. His piles at the end of the day were a clear and measurable indication of his productivity. He could choose to work steadily for several months or frantically for a few weeks. He could choose to be satisfied with a modest cut, or compete with himself and his camp mates for a "brag" cut. Such competitions were one way to make the job more interesting as well as more lucrative for him and his delighted employer. High producers were more likely to be assigned a "better chance" — strips with good timber and clean ground — by bosses interested in maximizing productivity. This practice increased the production of the better cutters and helps explain statistics which showed that in Abitibi's Sault district, 80 per cent of production was cut by only 20 per cent of the crew.[61] There was no stigma attached to high producers. Rates were industry-wide and agreed upon in the union contract. A high producer was simply regarded as a strong, fast worker with high earnings.

The men who chose to work at piece rates in logging camps tended to like the piecework system because it meant independence from supervision, higher earnings than day wages on comparable jobs, and incomes tied to individual effort and skill. Department of Labour figures suggest that during the 1950s, piece-rate earnings were on average far higher than day rates for equivalent job categories in the Ontario pulpwood sector.[62] In a time-and-motion study of skidding, it was found that time wasted on delays was 97 per cent higher among day workers, and the wage worker spent well over twice as much time resting as the pieceworker.[63] This also points to the trade-off for workers. Piecework meant higher earnings but much more arduous work and "burning out" at an early age. Few pieceworkers exceeded forty-five years of age. One manager justified mechanization on the grounds that it would prevent the "bad practice" of men "working too long hours intensively and continuously."[64] In how many industries did managers complain that their employees were working too hard?

As each technological change was introduced to logging, the labour process was affected, though in different ways and to varying extents, depending on the specific case. The chainsaw had the least impact on the work process. It simply replaced the axe and bucksaw without reorganizing the work. Pulpcutting remained a highly independent job, paid by the piece. For the worker, the chainsaw required few new skills, apart from some knowledge of motor maintenance, sawchain sharpening, and safety precautions.[65]

Chainsaws did increase the occupational health and safety hazards. Power saw cuts were more often severe, and it was easy to cut through a tree too quickly, or on an

61. Koroleff, *Stability*, p. 71. For a contrasting experience with piece rates see Michael Burawoy, *Manufacturing Consent: Changes in the Labour Process under Monopoly Capitalism* (Chicago, 1979).
62. Canada, Department of Labour, *Wage Rates and Hours of Labour in Canada*, 1951-1960.
63. CPPA, WS, *Pulpwood Skidding*, p. 34.
64. C.R. Townsend, "New Developments and Trends in Logging Techniques", WSI 590 (August 1940).
65. "Power Saw Training — Panel Discussion", WSI 1321 (March 1953).

angle, and thus lose control and be crushed by the falling timber.[66] Pieceworkers who owned their own saws took on additional risks, since they were motivated to work fast and were more likely to try to remove their valuable saws when a falling tree got out of control.[67] According to Ontario Pulp and Paper Makers Safety Association data, just 2 per cent of the disabling logging accidents involved machinery in 1946, but a decade later the proportion had increased to over 15 per cent; 103 of the 257 mechanical accidents involved power saws.[68] There were less obvious dangers, as well. Chainsaw vibration, which was especially severe with the early models, eventually caused permanent loss of feeling in some cutters' hands and arms. The roar of the saws not only greatly altered the atmosphere of bush operations, but frequently caused serious hearing damage as well. Nevertheless, these increased health and safety hazards did not deter cutters from adopting the new powersaws which lightened their work and increased earnings while still permitting a continuation of the cutter's independence.

Unlike the chainsaw, the wheeled skidder necessitated fundamental changes in the labour process and numerous adjustments on the part of workers and managers. Most significantly, the independence and individualism fostered by conventional methods were significantly reduced. Team work was now required in the new re-organized work process. Referring to the new skidder operations, an official at Dryden Paper Company in 1963 emphasized that logging had become "a closely-integrated *group* enterprise. Laws of group behaviour that didn't apply are at work now."[69] Since skidders could operate nearly year round, cutting and skidding became closely synchronized, the logs being skidded almost immediately after the trees were felled. Cutters and skidders now had to co-ordinate their work. Moreover, the wheeled skidder's capacity for transporting several full trees or tree-length logs at a time permitted management to implement a further division of labour. Instead of fellers bucking the trees into logs at the stump, bucking was performed by a bucker/piler who worked under the more controlled conditions of a road-side landing where mechanical slashers and loaders might be used. A cutter on his strip and a bucker/piler at the road side formed a crew. The skidder operator skidded for a few crews, the number depending on the speed at which terrain, topography, and weather conditions permitted him to move about. He became the co-ordinator and pacesetter for his team.[70]

With the introduction of skidders, the rhythm of work changed. Although the cutter still planned and executed the cut on his strip, his control over the pace of his work was less complete than before because he was affected by the speed of the team as

66. "The Proper Use of the Power Saw as a Cutting Tool — Panel Discussion", WSI 1369 (March 1954).
67. Keith Mason, "The Effects of Piecework Accident Rates in the Logging Industry", *Journal of Occupational Accidents*, 1:3 (July 1977).
68. D.W. Gray, "Accident Prevention on Mechanized Operations", *Woodlands Review*, January 1958.
69. W.J. Windebank, comment in "A Symposium: Technical Change and Its Consequences on Woods Operations", WSI 2217 (March 1963).
70. "Small Skidder Forum", WSI 2140 (March 1962); W.D. Bennett, H.I. Winer and A. Bartholomew, *A Measurement of Environmental Factors and their Effect on the Productivity of Tree-Length Logging with Rubber-tired Skidders*, (PPRIC No. 22, 1965).

a whole. Skidder operators worked at a faster pace than teamsters had done, since the horse had limited travel to three to four miles per hour with frequent rest periods. At the same time, the development of skidders, the construction of access roads, and the increased use of truck hauling rather than river driving reduced the industry's dependence on winter and spring weather, making it possible to log nearly year round. This, too, affected the rhythms of work. In Silversides's words, "with mechanization must come discipline of work." Woodsworkers now had to adapt to the "steady pattern of a day's work, the week's and year's, which is accepted for the most part by a worker in a developed economy," but which "is often repugnant and strange to a forest worker who formerly worked at his own pace, often intermittently, and was to a degree a relatively free man."[71] Although most woodsworkers in Ontario's pulpwood operations had always been employees of large, modern firms, it was not until the coming of the skidder and team work during the early 1960s that many forest workers confronted the rhythms of industrial work for the first time.

As skidders were introduced, some companies — though not all — began to abandon the piecework system. The new team work made it more difficult to measure individual production, and the individual lost some of his ability to control his own productivity. "An important justification of piece work in the past," commented an observer, "was that the period of operations was short and, because productivity was directly dependent on the workers, there was a need to push them." Once productivity depended more on machinery and the operations became year-round, what appeared desirable was "not so much a feverish agitation of [a] few months as a sustained and regular progress on [sic] a longer period."[72] Workers paid at day or hourly rates were more closely supervised to ensure that the expensive new machinery was fully utilized, but not abused. However, on most operations the incentive principle was retained because, in the estimation of industry experts, some 40 per cent of the variation in productivity was "associated with such things as skill and motivation of the operator crew."[73] Individuals were usually paid a guaranteed basic hourly wage and then teams were given a production bonus to be divided among team members on the basis of an agreed formula.

The introduction of skidders gave management the opportunity to establish management-designed training programmes for skidder operators. Although some woodsworkers had had experience on farm and construction equipment resembling skidders, the latter were unique machines requiring handling and maintenance skills unfamiliar to woodsworkers. Not every company, however, saw an advantage in introducing training programmes. Woods manager Bill Thom maintained in 1965 that at Kimberly Clark they had not "found it necessary to institute formal training programmes for machine operators" because they had "built up a nucleus of trained

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71. Silversides, "Influences of Mechanization", p. 2804. On the changing rhythms of work see E.P. Thompson, "Time, Work-Discipline, and Industrial Capitalism", *Past and Present*, 38 (December 1968), pp. 56-97; Herbert G. Gutman, *Work, Culture and Society in Industrializing America* (New York, 1976), ch. 1.
72. Camille Legendre, "Improving Productivity: Expensive Hardware, Better Qualified Workers, How about the Organization?", WSI 2661 (1973).
73. Bennet, et al., "Measurement of Environmental Factors".

men, who in turn have trained others as the number of machines has increased."[74] Other firms such as Marathon Corporation and Dryden Paper set up formal courses to instruct new men and upgrade veteran employees. At Dryden the emphasis was on training supervisors in managerial and operating skills since supervisors were so much more important on skidder operations and they, too, lacked mechanical knowledge. Eventually most firms took advantage of federal and provincial funds to establish or participate in training programmes for skidder operators.[75] Equipment manufacturers also provided some training and issued illustrated manuals for operators.

These skidder operating manuals indicate some of the dangers involved in handling skidders as well as some of the skills required. Operators of Hawker-Siddeley's Tree Farmers were instructed to:

> DRIVE slowly over rough terrain and steep grades.
> DROP the load if the front wheels leave the ground when skidding logs uphill.
> NEVER winch-in a heavy load at an extreme angle. Any machine can be tipped over if improperly used.
> NEVER free-wheel at high speed. When engine r.p.m. drops you will not be able to steer.
> ALWAYS winch the load up to the arch otherwise it may hang-up and overturn the skidder.
> TAKE CARE not to tip the machine over frontwards when travelling downhill.[76]

It took practice and skill to know the meaning of "an extreme angle", "a high speed", etc. and good reflexes to avoid obstacles at fast speeds. Tipping over a fast-moving skidder was an obvious danger. Much less apparent were the risks to an operator's health of the high noise levels, vibrations, and jolting. A representative of Clark Equipment in 1974 admitted that much diesel equipment had been too noisy, in part because mufflers were "gutted so operators would 'appreciate' the power."[77] Silversides reported that manufacturers did not install springs on skidders as an economy measure, relying instead on the low-pressure tires which, in fact, transmitted and magnified oscillations thereby causing operators discomfort and endangering their health.[78] Not until the 1970s did the industry begin to think about improving operator comfort, after it was recognized that production was suffering because operators were forced to drive the machines at low speeds to avoid extreme discomfort.

Wheeled skidders gave operators other problems and discomforts as well. Since the versatility of the wheeled skidder hastened the transition to year-round logging, workers had to put up with the flies, mosquitoes, and humidity of summer, as well as the cold and snow of winter.

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74. Quoted in *Ontario Logger*, (May 1965).
75. D.A. Scott and P.L. Cottell, *Survey of Logger Training*, (Forest Engineering Research Institute of Canada [FERIC], T.R. 11, 1976).
76. Canadian Car, Division of Hawker Siddeley Canada Ltd., *Operator's Manual — Tree Farmer: Power Shift Models* (n.p., c. 1970), pp. 15-6.
77. Richard Holton, "Trends in Noise Suppression of Mobile Diesel Equipment", WSI 2649 (June 1974).
78. Silversides, "Introduction", in his *Forest Harvesting*, pp. 4-6. See also "Factors Affecting Productivity of Wheeled Skidders", WSI 2339 (March 1965); John R. Radforth, *Higher Travel Speeds for Off-Road Logging Vehicles*, (FERIC, T.R. 22, 1978).

Like skidders, harvesters and processors caused several important changes in the labour process. The working environment changed drastically. Since operators worked in enclosed cabs, they no longer were exposed to the dangers and discomforts that for so long had been associated with logging. The cab protected operators from sharp cutting devices and falling trees, and it insulated them somewhat from the roar of the engines and from the weather. Harvesters could be run twenty-four hours a day, and so, to make the best use of the machines, afternoon and grave-yard shifts were introduced at some camps. "Heaters in winter, fans in summer, portable air conditioning units, insecticides, lighting systems, etc. can, as far as the worker is concerned turn night into day and winter into summer," declared one observer in 1966.[79] In fact, during the 1960s equipment designers gave too little attention to operator comfort. In 1981 a manager recollected:

> Machine operation improved many a job, but it never became a guarantee for a good working environment. Instead of getting wet by the rain, the operator got overheated in a poorly ventilated cabin. Instead of heavy-lifting outside, he got day-long body vibrations from going back and forth with the machine. Instead of walking all day, he ended up standing all day because he could not see to operate the machine while sitting.[80]

During the 1970s, as the industry reassessed the harvesters, "human factors" became a priority for improving productivity.

Not surprisingly, equipment manufacturers stressed that their big, new machines were easy to operate. One magazine ad claimed, "Now instead of being limited to just strong men, even a woman can be the operator of a Roanoke Tree Shear!"[81] (Logging nevertheless remained a man's occupation.) Another ad for heavy equipment showed a photo of an attractive, young woman operating a Volvo machine with the caption, "Aw shucks, guys, this feller-buncher is a cinch to operate!"[82] Certainly the work was lighter, but skill and practice were still required in order to operate the big machines at peak production levels.

To the untrained eye, the cab of a processor or harvester with its dozens of gauges, levers, pedals and joy sticks appears as complicated as a jetplane's cockpit. The Hawker-Siddeley Tree Processor, for example, had a cab with a swivel seat permitting access to a front console with four large levers, a brake pedal, and clutch, as well as to a rear console with ten large levers, four foot pedals and countless buttons and knobs. In 1966 one author described the operation of a processing machine:

> To complete one cycle of operation, the operator utilizing both hands and both feet, goes through some 22 distinct but coordinated movements. This is completed in approximately fifteen seconds, and it has been calculated on this basis, and

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79. "Two Shift Logging: A Symposium", WSI 2091, (August 1961).
80. S. Milling, "Training and development needs of forest workers in the 80s", *Pulp and Paper Canada*, April 1981. See also R. Legault and L.H. Powell, *Evaluation of FMC 200 Grapple Skidder* (FERIC, T.R. 1, 1976).
81. *Woodlands Review*, August 1967.
82. *Pulp and Paper Canada*, December 1976.

> including machine moves and down time, that the operator does in one shift complete some fifteen thousand required movements.[83]

Operating these kinds of machines involved much repetitive work, though the variations in topography and trees provided some relief from boredom. An intensive study of shear operators concluded that the operator's "experience, manual dexterity, visual perception, and...motivation showed significant relationships with productivity."[84] Woodsworkers now had to have new types of skills relating to machine operation and repair, but skills were still required. Even in the case of the automated processing components of some harvesters, operator skills were needed. Since these parts broke down so frequently, it was an advantage if operators paid on an incentive basis could quickly repair their machines themselves and return to work.

Closer and more sophisticated supervisory techniques were perceived by management as the best means to improve operator efficiency. On some fully-mechanized operations two supervisors were assigned for every four to six operators and each cab had a two-way radio so that supervisors could maintain close contact with operators and mechanics. Work was planned and organized by the supervisors. Although the operator still worked alone in his cab and in his patch of forest, this was a far cry from the thorough-going independence of the old system and from the team work of cut-and-skid operations. It was argued that such close supervision paid since supervisors helped "motivate" workers and reduced downtime by speeding repairs and checking equipment abuse.[85] Human relations techniques developed for other industries were advocated for logging. To increase worker motivation, one labour relations expert recommended involving "responsible employees in work planning and scheduling" and "group work formations" in order to "subject the non producer to the judgement of his peers."[86]

Initially, woods managers were uncertain whether incentive payment was suited to harvester operations. One manager contended that, in fully mechanized systems, "it is important that supervisors foster continuous pride in accomplishment, so that the handling factor is emphasized rather than the productivity factor. The latter is built into the cycle of the machine." A survey concluded that "there was no association between method of payment of machine operators and their productivity." However,

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83. D.C. Mason, "The Effects of Changing Woodlands Operating Techniques on the Basic Job Characteristics of Woods Labour", CPPA, WS, Pulpwood Production Manpower Conference (November 1965), cited by Silversides, "Influence of Mechanization", p. 2807.
84. P.L. Cottell, et al., *Performance Variation among Logging-Machine Operators: Felling with Tree Shears* (FERIC, T.R. 4, 1976), p. 25. See also Paul L. Aird *et al.*, "Evaluating the Productivity of Logging Machines: Studies of Beloit Harvesters", WSI 2588, (March 1970); P.L. Cottell and R.J. Barth, "Factors Relating to Performance Variation", *Relations Industrielles/Industrial Relations*, 32:4 (February 1977), pp. 566-85.
85. G.K. Seed, "The Machine Resource — Current Options", WSI 2617 (March 1972).
86. D.M. Johnson, "The Manpower Situation", WSI 2622, (May 1972). By the late 1970s the School of Forestry at Lakehead University offered a diploma in Mechanized Forest Operations intended to train men as supervisors. The curriculum included courses which taught the role of supervisors in staffing, motivating, co-ordinating, and evaluating the workforce, stop-watch sampling techniques, use of automated recording instruments, cost analysis, etc. (Lakehead University, *Calendar*, 1979).

American Can of Canada operations officials "strongly advised the use of bonus systems," and this indeed proved to be the trend.[87]

Another approach for improving productivity in fully-mechanized operations was to try to check the soaring costs of maintenance and repair which a 1971 paper reported had reached about 46 per cent of the total operating costs of the complex harvesters.[88] Woods managers developed elaborate preventive maintenance programmes, utilizing computers to co-ordinate maintenance schedules and parts supplies. Observers marvelled at the contrast between the dingy camp blacksmith's shop of 1950 and the big, bright shops of the 1960s where it was "not uncommon to see mechanics in a workshop spreading out white paper towelling before working on hydraulic pumps...."[89] Work in the camps changed, too, because many more highly specialized mechanics were needed to service the new machines. An Industry Trade and Commerce study noted that experienced mechanics in the logging industry were "not always able to maintain more complex equipment such as harvesters."[90] Since it was so difficult to attract highly-specialized mechanics to remote camps, training programmes were introduced to upgrade existing employees, instructing them in the maintenance of diesel engines, automatic transmissions, hydraulic and electrical systems. Well-paid, highly skilled jobs opened up in logging because of the new machines.

Each major technological innovation thus involved some degree of change in the labour process. Forest conditions, however, had prevented management from gaining complete control over the labour process and from eliminating operator differences based on skill, perception, and reflexes. Mechanization had transformed the worker with his traditional woodlot skills into an equipment operator with new skills. The work could not be sub-divided into minute, repetitious tasks. Woods managers may have hoped to deskill logging, but they made little headway in this direction. The trend towards the deskilling and degradation of work under monopoly capitalism as analyzed by Harry Braverman[91] is apparent in the case of logging, but it is not a marked trend. Making the best of the situation, the industry, in order to improve the image of woodsworkers and attract more men to the bush, trumpeted the fact that woodsworkers needed sophisticated skills.

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87. UTA, Michell Papers, minutes of Logging Operations Group meeting, 11-13 May 1976. See also Sari Stock, "Bonus Systems Still Need Close Study", *Pulp and Paper Canada*, May 1977.
88. Silversides, "Achievements and Failures".
89. R.T. Carter, "The Canadian Labour Force in 1964", WSI 2333 (March 1965).
90. Mechanical Transport Branch, "Mechanization in the Forest", p. 32.
91. Harry Braverman, *Labour and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York, 1974). Logging differs from many other industries where technical change has replaced both the skilled and the unskilled with semi-skilled labour. Consequently there is no justification for speculating, as Clement has done in the case of hardrock mining, that "the overall trend is towards a homogenization of the working class in mining. The net effect may well be a stronger, more unified class in a political and ideological sense...." ("Subordination of Labour", p. 148.)

WORKERS' RESPONSES

Although each major technological innovation affected the labour process in different ways and to different extents, woodsworkers seem to have responded to the changes in a remarkably uniform manner. Overwhelmingly, bushworkers and their union, the Lumber and Sawmill Workers Union, welcomed each change after some initial hesitations.

That bushworkers showed some hesitation about management's new technology is scarcely surprising. Even chainsaws, which were most often introduced by equipment salesmen rather that woods management, were at first eyed with suspicion — justifiably since early models frequently broke down and their vibrations were annoying. A University of Toronto forestry student visiting Long Lac's operations in 1948 found that pieceworkers who had purchased Precision chainsaws had become disillusioned because, unable to keep their saws in working order, they had lost money using them.[92] When management first introduced new equipment such as skidders, harvesters and processors at the work site, labour-management conflicts sometimes erupted over the setting of fair piece-rates or bonuses. At one Spruce Falls camp in 1957, for instance, a wild-cat strike occurred when the company replaced horses with John Deere tractors and set the piece rates at a level the men felt was too low. (In this instance, the company's immediate solution was to maintain production by returning to horses for the remainder of the operating season.)[93] Management observers reported that workers were often suspicious of new harvesting equipment, regarding each new machine was "just another head office toy." It was also reported that workers on incentive pay often sabotaged trials of new equipment when they believed the innovation might disrupt production even for a short period.[94]

What may seem more surprising is that instances of conscious resistance to technological change were so few. Of course, there are few, if any, examples of unions in any industry that have successfully prevented the introduction of new technology in the twentieth century. Yet, the very high degree of acceptance among Ontario's woodsworkers does require explanation, especially since the innovations forced workers to adjust to such dramatically different methods and the number of jobs in the industry fell from some twenty-five thousand seasonal jobs in 1950 to about seven thousand year-round jobs in 1970. A satisfactory explanation for this smooth transition must take into account both the nature of the logging labour force and the peculiar way in which the technological changes affected that workforce.

Despite the ethnic diversity of the logging labour force, which was composed of English-speaking Canadians and French Canadians, as well as European immigrants,

92. UTA, Faculty of Forestry Collection, Logging Reports, R.B. Laughlan, "Logging Report: Longlac Pulp and Paper, 1948". See also W.B. Megan, "The Application of Power Saws in Eastern Pulpwood Logging", WSI 829, (January 1946).

93. *Ontario Bushworker*, 18 February 1957; UTA, Faculty of Forestry Collection, Logging Reports, R.G. Lightheart, "Logging Report: Spruce Falls Power and Paper Company, 1957".

94. H.I. Winer and M. Ryans, *Organizational Factors Affecting Trials of New Logging Machines*, (FERIC, S.R. 10, 1980). See also Ivar F. Fogh, "Effects of Technological Change on Woods Operations", *The Forestry Chronicle*, 44:1 (February 1968), pp. 30-6.

Ontario's bushworkers had one strong, common characteristic: they placed a very high priority on maximizing their incomes. Men were willing to put up with the industry's tough working conditions and the deprivations of remote bush camps as long as the money was attractive. They endured the rigours of piecework because it seemed to increase their earnings. In the post-war period, a large proportion of bushworkers were recent arrivals from many parts of Europe — Estonia, Hungary, Portugal, etc. Each new wave of immigration brought together in the bush camps young men with little knowledge of English or French who were attracted by the good wages and low boarding costs that would enable them to get a start in this country. Their common commitment to making high wages did much to overcome ethnic rivalries and unite them in support of union efforts to improve their wages. At the same time, the competitiveness inherent in the labour process with its incentive pay systems reinforced their insistence that good wages must come before other gains such as portable pension schemes.[95]

The technological innovations of the 1950s and 60s appealed to this labour force largely because they tended to increase workers' earnings. In the early 1950s when chainsaws were introduced, piece rates were set for the number of cords cut and piled; the choice of cutting tool was left to the employee. Once the reliability of chainsaws was established, men readily purchased them because incomes could rise from 20 to 100 per cent depending on an individual's skills. A thirty-year veteran woodcutter recently recalled that even the heavy, awkward chainsaws of the early 1950s were regarded by pieceworkers as "quite a thing for us at the time.... You could do more; you could produce more and limb easier. Everybody was for it."[96] Employees' outright refusal — expressed in the form of wildcat strikes — to accept lower wages as a result of a new piece of equipment prevented management from making savings by cutting wages directly. But higher productivity did result in cost savings accruing to the companies, some of which were passed on to workers. At the same time, strong product markets, the industry's expansion, labour shortages and union pressure combined to ensure steadily rising real incomes throughout the period. The new methods also meant more secure incomes because the shift to year-round logging (as well as seniority provisions) gave those bushworkers who wanted steady work the opportunity to find relatively permanent, secure jobs. Furthermore, the new methods eliminated much of the "bull work" so that employees could work for longer periods without "burning out" and older men could stay on the job, which meant that far greater savings were possible in the course of a lifetime.

Workers did not perceive the new jobs as degrading. The work required highly-prized mechanical skills, which were transferrable to, and demanded by, other industries. This increased the flexibility and bargaining powers of woodsworkers. Workers in the new systems still took pride in their skills. Describing cut-and-skid team work, a woodcutter said:

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95. LSWU Local 2396 President Tulio Mior and former business agent Lothar Bode, interviewed by author, July 1982.

96. Jake Hildebrand interviewed by James Swift, July 1981, copy of transcript in author's possession.

> We work as a unit. One guy will know exactly where the other guy is and what he's going to do. It comes with experience and ability. When they call you a professional woodcutter they mean it.... It's just like a carpenter. A carpenter is a professional and so is a woodcutter. You can't learn that in one day.[97]

Harvester operators enjoyed the highest hourly rates of all production workers and the prestige of operating the biggest, most powerful, and expensive equipment in camp. A Great Lakes Paper supervisor claimed that it was easy to hire harvester operators since men regarded "the Koehring as the prime machine, the highest echelon in the woods."[98] Certainly, in the eyes of most workers, the numerous attractions of new equipment far outweighed the bad health and safety features — vibrations and dangerous, high-speed blades and moving parts.

Yet, all of these appealing effects of mechanization would not have been enough to ensure labour's acceptance if mechanization had resulted in mass lay-offs. Although the new technology had drastically reduced manpower requirements — as management had intended — mass lay-offs were unnecessary because of Ontario logging's specialized labour market. The seasonality of the industry and the high labour turnover rates meant that employers rarely had to fire employees. As a 1966 Department of Manpower and Immigration study noted, "the level of voluntary quits is so high in this industry that it would be possible to theoretically reduce the woods labour force to zero in the space of twelve months without laying off a single individual."[99] Gradually there were fewer and fewer jobs in the industry, but, then, fewer men were offering their labour power in the bush in any case. Some did suffer because of the shrinkage of job opportunities, especially those men who had quit one year, expecting to find a job as usual the next winter. It is impossible to estimate how many felt themselves to be out of a job in this way. What is clear is that, unlike those laid off in most other industries as a result of labour-saving technology, former woods employees had no direct claim on their previous year's jobs and no ready means to organize against their former employers. Because of the fluidity of the woods labour market, management enjoyed the opportunity to introduce labour-saving equipment with little risk of labour protest.

The Lumber and Sawmill Workers Union, which regularly signed contracts with all the pulp and paper companies from 1946 onwards, presented no major obstacle to managers intent on introducing mechanized methods. No union-sanctioned strike was fought during the 1950s and 60s on the issue of technological change. This was not because the Lumber and Saw was a weak union. On the contrary, it had a militant tradition, gave strong leadership to its members and enjoyed their solid support largely because the union had been able to win the wage increases that were such a priority for

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97. *Ibid.*
98. Don Harris interviewed by James Swift, August 1981, copy of transcript in author's possession.
99. Campbell and Power, *Manpower Implications*, p. 108.

bushworkers.[100] In its newspaper, *The Ontario Timberworker*, the union leadership justified acceptance on the new machinery by pointing to historical precedents:

> You can't hold back machinery...Hand weavers and artisan shoemakers gave up their crafts and went into factories where machines could work ten or 100 times as fast as they could.[101]

More important were the potential benefits for union members that the new logging methods seemed to offer - - "increased productivity" which could mean higher earnings and "less back-breaking work." In the late 1950s, the union not only claimed some of the credit for mechanization, but it went so far as to complain that "far too little" was being done "about higher mechanization, experiment and research work with the result that a great deal of effort, time and money is wasted with inefficient logging methods."[102] In stressing the practical benefits of mechanization, union leaders were no doubt expressing the feelings of the bulk of the membership. Furthermore, union leaders saw potential advantages for the union itself in the form of a smaller, but more stable membership with members more committed to the union as a result of their long-term commitment to their jobs.

The most dangerous threat to the union that mechanization posed was contracting in its various forms. Mechanization brought a substantial increase in the cost of equipment. One way for companies to avoid incurring such costs was to encourage contractors to provide the equipment. The Lumber and Saw was well prepared for this management strategy since jobbing had long been practised in logging operations and their employees logging on company limits were covered by the terms of the collective agreement throughout the post-war period. Each time during contract negotiations, the companies would attempt to remove or weaken this provision, but the union succeeded in resisting management's efforts.[103] Lumber and Saw could do nothing, however, to prevent companies from buying wood produced on small, private woodlots or Crown lands licenced to contracting firms. Generally speaking, this was not too serious a problem for the union in Ontario, although in 1963 settler contractors logging on private land did undermine a strike in the Kapuskasing area of the Great Clay Belt, an agricultural district where there was an unusually large number of settler operators. Bitter conflicts between pickets and contractors climaxed

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100. On the militant traditions of the LSWU see my "Finnish Lumber Workers in Ontario, 1919-1946", *Polyphony*, 3:2 (Fall 1981), pp. 23-34; Satu Repo, "Rosvall and Voutilainen: Two Union Men Who Never Died", *Labour/Le Travailleur*, 8/9 (Autumn/Spring 1981/82), pp. 279-302; Livo Ducin (pseud.), "Unrest in the Algoma Lumbercamps; the Bushworkers' Strikes of 1933-1934", in John Ferris, ed., *50 Years of Labour in Algoma*, (Sault Ste. Marie, 1978).
101. *Ontario Timberworker*, 15 August 1948.
102. *Ontario Bushworker*, 17 September 1956 and 4 February 1957.
103. See regular reports on negotiations in *Ontario Bushworker* throughout the 1950s and '60s.

in a midnight tragedy when settlers armed with shotguns opened fire on strikers, killing three of them.[104]

The widespread worker and union acceptance of the new technology would seem to have given management nearly ideal conditions for obtaining maximum productivity from mechanized methods. This was not the case, however. Despite all the changes, woodsworkers remained in short supply and, most significantly, many continued to quit their jobs regularly. For instance, C.R. Day, Director of Industrial Relations Services for the Canadian Pulp and Paper Association, reported that in the fall of 1972 eastern Canadian woodlands operations had faced "a critical shortage of manpower" and very high turnover rates, a situation Day found "totally irreconcilable with the high rate of unemployment then being experienced in Canada."[105] On the one hand, the shift to mechanized, year-round operations, the construction of access roads, as well as pension plans and seniority provisions had greatly stabilized the logging labour force in districts near urban centres. By the 1960s, many woodsworkers could commute to their worksites by car or company bus. These jobs attracted those men with the most seniority and so a steady, resident, and older workforce gradually emerged in commuter operations and at the depot garages in town. On the other hand, a large proportion of logging jobs were still in remote camps that attracted younger men looking for "fast money" or desiring training in a skill such as welding or heavy equipment operation. Much to management's alarm, these woodsworkers continued "to move on to greener pastures at more or less regular intervals."[106] In at least one way, mechanization actually increased the propensity of workers to jump: the skills of heavy equipment operators, mechanics and other tradesmen enabled them to take jobs demanding similar skills in construction, mining, and other industries.

Labour's instability not only added to production costs as it had done in conventional logging systems, but in the fully mechanized operations the workers' propensity to jump also wreaked havoc on production schedules and cost projections.

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104. On the Kapuskasing strike see D.L. Stein, "Violence and death strike Ontario's quiet north country", *Maclean's Magazine*, 23 March 1963; *Ontario Bushworker*, 15 February 1964. Contracting proved to be a serious threat in northwestern Ontario in the late 1970s, after the period under review here, when Boise Cascade tried to encourage its woodlands employees to purchase their own expensive, wheeled skidders. See my "Roots of the Loggers Strike at Boise Cascade Canada, Ltd., 1978-80", paper presented to the North American Labour History Conference at Wayne State University, 1982. Contracting has also been a major problem in other regions. See, for example, W.C. Osborn, *The Paper Plantation: Ralph Nader's Study Group on the Pulp and Paper Industry in Maine* (New York, 1974); Patricia Marchak, "Labour in a Staple Economy", *Studies in Political Economy*, 2 (Autumn 1979); Camille Legendre, "Le Développement et les Organisations: Le Destin des Entrepreneurs Forestiers", *Canadian Review of Sociology and Anthropology*, 17 (1980), pp. 246-62.

105. C.R. Day, "An Analysis of Woodlands Manpower", WSI 2633 (March 1973); George McLeish, "People do want to work in the bush", *Pulp and Paper Canada*, May 1974.

106. Johnson, "The Manpower Situation". On labour turnover in mechanized operations see J. Kenneth Pearce and George Stenzie, *Logging and Pulpwood Production* (New York, 1972), p. 209; D.A. Scott and P. Cottell, *Survey of Logger Training* (FERIC, T.R. 11, 1976) and C.A. Kearns, "Recruitment and Retention of Employees Forestry and Mining", unpub. Canada Manpower study, 1974.

In order to make the big machines pay, it was essential that they operate continuously. Disruptions caused by high turnover rates, and the continual training of new employees, added greatly to costs. In 1971 G.K. Seed, Logging Development Engineer at Great Lakes Paper, argued:

> Investment in woods equipment has reached such proportions that operations can't be stopped without serious loss. Further, the job has become so skill demanding that it is difficult to satisfy operational requirements through substitution. It is essential to minimize absenteeism.[107]

Managers perceived that eliminating high turnover and absentee rates would be extremely difficult because of their complex socio-economic and psychological causes, not the least of which was that many men were attracted to logging because they could change jobs frequently. One study based on interviews with forest workers in British Columbia concluded that most men were always on the lookout for another job. "Security for these men lay in their mobility itself.... They took pride in the portability and variety of their skills, and ability to 'do anything' and be a 'jack of all trades'. It was frequently said that: 'I could quit here Friday night and have another job to go to Monday morning'. "[108] Because of the persistent problem of attracting men to the bush, the industry was compelled to hire men who liked to jump. Not only were companies forced to restrict the use of harvesters because of their mechanical limitations, but this instability of labour further limited their use. Cut-and-skid techniques continued to be widely applied. Therefore, the behaviour of these workers helped preserve more jobs since cut-and-skid methods were more labour intensive, and woodsworkers enjoyed a choice between working in two kinds of logging systems. Those who preferred the relative freedom from supervision in cut-and-skid operations had that option; others preferred the relative comfort and safety of the prestigious big machines. Although most workers were not consciously trying to limit management's freedom to deploy the technology of its own choosing, nevertheless they had done precisely that.

CONCLUSIONS

While woods managers in the pulp and paper companies ultimately made the decisions regarding the design and deployment of technologies, their choices were shaped and limited by physical factors related to the raw material and the natural environment and by the decisions and behaviour of workers. There is no pre-determined or automatic relationship between the corporation and advanced technology. In their woodlands operations before about 1950 the modern, science-based pulp and paper companies of Ontario relied on conventional, labour-intensive techniques developed decades earlier by the family firms of the lumber industry. The peculiar forest conditions of the north prevented the companies from adopting cutting and skidding technologies deployed successfully in other regions. Moreover, only labour-intensive methods were cost-

107. G.K. Seed, "The Machine Resource — Current Options", WSI 2617 (March 1972).

108. Philip L. Cottell, "Why Work in the Woods?", WSI 2662, (October 1974). The same point with regard to northwestern Ontario was made by Don Harris, interview. On turnover see Johnson, "The Manpower Situation".

effective at a time when so many were willing — or felt compelled — to work in the bush.

After 1950 or so, a number of factors forced the companies to adopt a strategy of mechanization; chief among them was a shortage of woods labour that threatened to disrupt wood supplies to the mills and increase production costs to such an extent that the competitiveness of the industry's pulp and paper products, and ultimately corporate profits, seemed threatened. After more opportunities opened up in urban centres, fewer men chose to work at less secure, seasonal jobs in the remote lumber camps where outdoor working conditions were tough. In remarkably short order, the companies developed or adopted several new pieces of equipment so that two logging systems were available: cut-and-skid techniques and fully-mechanized operations using harvesters. Neither system was entirely satisfactory from management's point of view. Cut-and-skid methods were relatively labour intensive, while harvesters could not perform in all conditions and were subject to frequent breakdowns and costly disruptions arising from unstable labour. Continuing shortages of woods labour, related to the difficulty of attracting men to distant and ever-moving work sites, gave those workers who enjoyed changing jobs frequently the opportunity to do so. Since their jumping was particularly costly in the new, integrated logging systems, management was further constrained in its deployment of harvesters.

David Noble has emphasized that there is a social choice involved in the design and use of technologies, a choice made by those with the power to choose. He argues:

> The technology of production is...twice determined by the social relations of production: first it is designed and deployed according to the ideology and social power of those who make such decisions; and second, its actual use in production is determined by the realities of the shop-floor struggles between classes.[109]

In the case of pulpwood logging in Ontario, woodlands managers of the pulp and paper corporations were responsible for developing and introducing new equipment. Yet, to use Noble's words, "the actual effects [were] not consonant with the expectations implicit in the original designs."[110] The actual use of the new logging equipment was partly determined by physical or environmental constraints which hindered logging engineers from developing sophisticated labour-saving machinery capable of performing efficiently under the varied and variable conditions encountered in Ontario's boreal forests.[111] The actual use of the new logging equipment was also affected by workers who, despite all the changes, continued to choose to work in other industries and to jump in their accustomed manner. Such behaviour seriously reduced

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109. David F. Noble, "Social Choice in Machine Design: The Case of Automatically Controlled Machine Tools", in Andrew Zimbalist, ed., *Case Studies on the Labour Process* (New York, 1979), p. 19.

110. *Ibid.*

111. There are striking parallels between logging and another resource extraction industry — coal mining — where Michael Yarrow has found that new technology recently introduced by eastern United States coal operators has failed partly because of "technical and geographical factors" related to the miners' "unpredictable work environment". See Michael Yarrow, "The Labour Process in Coal Mining: Struggle for Control", in Zimbalist, *Case Studies*, pp. 170-92.

the overall efficiency of logging systems using the sophisticated harvesters. Because of the peculiar labour market in logging resulting from the reluctance of men to work steadily in remote bush camps, workers had some power to restrict management's freedom to deploy the technology it preferred. However unconsciously, woodsworkers had preserved jobs in the industry and given themselves the opportunity to choose between working with two kinds of logging systems, each of which had appeal for certain workers. The power of woodsworkers to shape management's decisions should not be exaggerated, nor should the extent of their choice. After all, the technology for both systems had been developed or introduced by the corporations. Management had remained in control throughout the industrial revolution in the woods. Social relations, defined in the broadest sense, had remained stable despite the dazzling technological innovations and the host of changes in the labour process.