LOCAL EMPLOYMENT MULTIPLIERS FOR THE PULP

AND PAPER INDUSTRY IN NEW ZEALAND

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ABSTRACT

Local employment multipliers for new pulp and paper mills ranging from 1.1 to 1.4 are derived from a study of Kawerau, a town almost totally dependent on the pulp and paper industry.

Estimates of local employment multipliers for new plants are shown to be highly sensitive to the extent of under-employment in the region prior to the plant's establishment. Any under-employment results in some of the servicing being undertaken by the existing servicing workforce, and in some of the jobs in the mills being taken, on a short-term basis, by farmers and workers in farm-associated occupations.

INTRODUCTION

Wood inputs make up about one half by value of the materials used in the pulp and paper industry in New Zealand (Department of Statistics, 1973a). Since the unit cost of wood is significantly less than the unit cost of other materials (mainly chemicals), wood constitutes considerably more than half by bulk of materials used. Pulp and paper mills typically reduce the bulk of wood in comparison to the bulk of products by 50-70 percent. Consequently, the joint cost of transporting materials and products is minimised by locating the mill close to the source of wood — the forest.

Further, the development of a pulp and paper industry in New Zealand offers hope for diversification of the economy since the present industry operates under a low level of effective protection (Elkan, 1972) and competes in the international market selling 20-30 percent of its production in other countries.

With the increasing emphasis on regional development in New Zealand, these factors have led to the establishment of pulp and paper mills being seen as a way of encouraging regional development without having to incur national costs, such as transport subsidies or suspensory loans. The establishment of the towns of Tokoroa and Kawerau as centres of population based on the pulp and paper industry provides visible evidence of the industry's developmental effect.

Because a considerable part of the concern for regional development has been the employment-generating impact of rurally located industries, the local employment impact of forest processing has become widely accepted and local employment multipliers (total employment generated by and within an industry, expressed as a ratio to the number of persons employed within the industry) have recently been used in regional

forest planning (New Zealand Forest Service, 1975) and in support of private bids for state wood resources (Fletcher Timber Company, 1975).

However, no derivation of the local employment multipliers for different industries in New Zealand has yet been published, and those multipliers which have been used could be subject to considerable error. At the same time, the two analyses previously cited which do incorporate a local employment multiplier effect have illustrated the over-riding importance of the multiplier in the assessment of the economic impact of a processing scheme. For the forest planning example at least, a change in the local employment multiplier could alter the form of forest processing considered desirable.

DERIVATION AND DISCUSSION

The Use of Multipliers

Income and employment multipliers for forest products industries ranging between 1.5 and 2.0 have been estimated from regional input-output studies in Australia (Ferguson, 1972), and in the southern United States employment multipliers ranged from 1.6 for sawmills to 3.7 for pulpmills (Kaiser and Dutrow, 1971).

In New Zealand, Ichikawa (1971) showed that the total linkage effect of the pulp and paper products industry (including carton and bag manufacture and paper converting) was exceeded only by that of the chemical fertiliser and the wood manufacturing industries. Largely because of this high linkage effect, an employment multiplier of 2.0 has been used in evaluating regional forest plans in New Zealand (New Zealand Forest Service, 1975).

However, future pulp and paper mills in New Zealand will be producing for an export market. The forward linkages[1] for the pulp and paper products industry assessed by Ichikawa (1971) and the Department of Statistics (1975) are based on the use of the industry's output in further processing in New Zealand. This cannot occur if the output is exported, and the forward linkage which should be used can be expected to drop from 80 (given in the 1965-66 input-output table for the pulp, paper, and paper-converting industry) to 5 for pulp and paper mills exporting total output[2] (Table 1).

Further, the forest on which most of New Zealand's future forest industries will be based is at present being established. Consequently, in discussing the merits of alternative forest processing industries or in comparing forest processing with alternative industries in New Zealand, the backward linkage to forestry and logging can be disregarded since these activities will necessarily take place even for log exports[3]. This reduces the backward linkage from 56 for the total paper products industry to 38 for

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[1] Forward linkage of an industry is the percentage of its output which serves as inputs to other industries. Conversely, the backward linkage is the proportion of its inputs which are produced by other industries.

[2] A forward linkage of 5 is derived by taking the total direct and indirect production required of the pulp and paper industry to provide one dollar of output for final consumers. From Table 1.3 of the 1965-66 Input-Output tables (Department of Statistics, 1975) this is 1.053. The forward linkage is therefore 0.053/1.053 = 5 percent.

[3] This assumes a common labour requirement for the forestry and logging necessary to support the alternative industries. While the forest labour required for sawlog regimes is greater than for export logs this is largely offset by the increased employment in logging (Fenton, 1972). Location and terrain may influence the labour requirements of one regime more than another, so no generalisations are possible.

TABLE 1—The interdependence of industries

	1965-66			1959-60
	Backward linkages*	Forward linkages*	Total linkage*	Total linkage†
Chemical fertilisers	53	85	138	140
Wood and cork products	53	85	143	150
Pulp and paper products	56	80	136	134
Economy average	42	39	81	—
Pulp and paper	49	75	124	—
Cartons and paper bags	65	89	154	—
Paper products N.E.I.	59	80	139	—
Pulp and paper for export ‡	38	5	43	—

* Department of Statistics (1975)
† Ichikawa (1971)
‡ Excluding linkages to forestry and logging

pulp and paper mills based on a resource which is established (or will be established irrespective of the existence of a processing plant).

Even this lower estimate of the backward linkage is likely to be an overestimate of the local impact since approximately 20% of the non-forest intermediate inputs of pulp and paper mills is for energy including petroleum products, coal, electricity, and gas, and another 20% is in commercial servicing including trade, banking, and insurance (Department of Statistics, 1975; Table 1.1). Not all of these facilities will be provided from within the region, and this emphasises the need to differentiate between the local and national impacts of any pulp and paper mills established.

For these reasons a local multiplier derived from a detailed analysis of an existing pulpmill's impact on the local economy was preferred to an input-output based multiplier. Multipliers based on local impact analysis offer the additional advantage that it is possible to "correct" the multipliers if the future industry is likely to have slightly different characteristics from the present industry.

By using local impact analysis on a specific town it is possible to take advantage of the special characteristics of that town. For example, the total output of the two pulp mills in Kawerau is exported from their employment region and the workforce associated with the mills is geographically separated from the workforce associated with the forestry and logging operations. The Tasman Pulp and Paper Company's sawmill, associated groundwood and newsprint mill, Caxton's refiner groundwood and tissue mill, and the populations associated with the mills are at Kawerau, but the forestry and logging operations which support them are primarily at Murupara, 65 kilometres away.

These mills are therefore likely to have had an impact on local employment and income similar to that of future export-based operations, and they offer the opportunity of separating the forestry and logging effect from the processing. In addition, as the town of Kawerau was established to support the Tasman mill, basic/non basic ratios

and employment multipliers are not complicated by under-employment in the original servicing workforce.

Estimating the Multiplier at Kawerau

One of the features of pulp mill developments at Kawerau is the large workforce engaged in construction when the pulp mill or the paper mill is expanded. Nevertheless it is apparent from Fig. 1 that the periodic expansion of the construction workforce
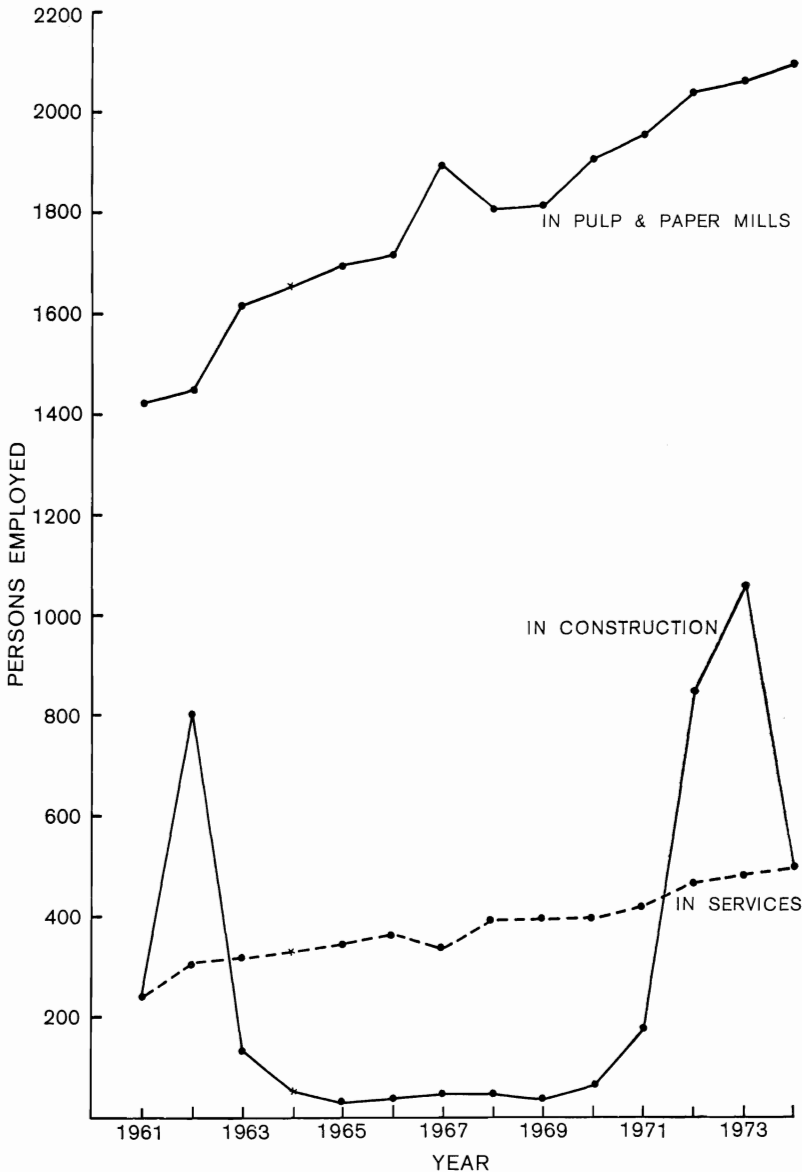

FIG. 1—Growth of workforce in Kawerau. Values for 1964 are estimates (from Department of Labour surveys of labour and employment) because no survey was undertaken that year.

does not significantly alter the growth of the workforce involved in trade, banking, insurance, accommodation, transport, education, health, and other personal servicing. The growth in this servicing workforce appears to be related to growth in manufacturing rather than to any change in the level of construction.

Another feature of employment in the pulp and paper mills at Kawerau is the high proportion of the workforce which commutes from outside the borough. In 1961, 286 people or 20% of the workforce of the pulp and paper mills commuted (Whitelaw, 1961); by 1971 an estimated 571 manufacturing workers (27% of the manufacturing workforce) and 112 construction workers (40% of the construction workforce) commuted[4].

In his survey Whitelaw (1961) also found that Kawerau had no hinterland or trade area. This opinion has been reinforced by a close examination of recent census of population and half-yearly labour surveys in which it was found that there was no manufacturing industry in Kawerau exporting from the borough, apart from the pulp and paper industry. Undoubtedly some part of the servicing sector's output, such as accommodation and petrol sales to tourists, and even some of the retail sales, may be classified as exports. However in the absence of a defined hinterland these are likely to be minor.

The absence of a hinterland also makes it impossible to estimate leakage effects by comparing Kawerau with other towns of similar size. However, because of the relative isolation of the town the leakage effect is not likely to be large. Further, whatever the leakage from Kawerau, a similar leakage could be expected from any new pulp mill development unless it was located adjacent to a major centre of population. Consequently a good estimate of the local employment generating effect of the pulp and paper industry can be derived by dividing Kawerau's total workforce by the employment at the pulp and paper mills (including the Tasman Pulp and Paper Company sawmill)[5].

Unfortunately, the discrepancies between the various estimates of the workforce and the uncertainty about the effect of commuting cause variations in the estimates of the employment multiplier (Table 3). The difference between the estimates of employment multipliers in 1961 and 1971 can be attributed to the development of a heavy-engineering industry in Kawerau during this time. In both the 1959-60 and the 1965-66 Input-Output tables (Department of Statistics, 1966; 1975) metal working and heavy engineering made up approximately 4% of pulp and paper mills' total intermediate output, but it was not until 1968 that the industry developed in Kawerau and by 1971 employment in heavy engineering had stabilised.

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[4] The 1971 Census figures indicate that only 487 people commuted to work in Kawerau (Department of Statistics, 1973b; Table 4.1) but this figure is likely to be biased by the fact that some commuters working occasionally at the mills would regard themselves as farmers or seasonal workers in completing the census. Consequently, a more accurate impression of commuting is gained by comparing the Labour and Employment figures with the Census employment estimates (Table 2). This is the approach used in deriving the figures in the text. It also indicates that the Labour and Employment Surveys under-estimate the servicing workforce in Kawerau by 115 people.

[5] This company currently employs 38 people in an afforestation programme which is not the basis for present mill production. Accordingly these people have been excluded in deriving employment multipliers.

TABLE 2—Full-time employment in Kawerau by industry

	Census of population March 71*	Department of Labour Survey of Employment		
		April 1971	April 1961	1961-1971
Primary (forestry and logging)	38			
Pulp, paper mills, and associated sawmill	—	1952	1422	530
Total manufacturing	1550	2121	1432	689
Construction	163	275	259	16
Servicing —				
trade and accommodation	221	142	76	66
business	29	23	14	9
transport and communications	84	71	49	22
personal and community	215	198†	104	94
Total servicing	549	434	243	191
Total workforce	2340‡	2830	1934	896
Non-construction workforce	2177	2555	1675	880
Servicing — private	—	527	392	135
Government	—	182	110	72
TOTAL	—	709	502	207

* Department of Statistics (1973c)
† includes an estimated 91 educational employees because education was not completely surveyed in 1971
‡ includes 40 persons not classified

TABLE 3—Local employment multiplier (excluding construction workforce*)

	Basis	Multiplier
1961	Labour and Employment Survey	1.22
1961-71	Growth in workforce shown in Labour and Employment Survey	1.66
1971	Census	1.40
	Labour and Employment Survey	1.41
	Composite (487 commuters)	1.49
	Composite (571 commuters)	1.52

* Construction workers are excluded because no reliable estimate of a base construction workforce can be made. In any event, this is certainly less than 50. Thus the maximum effect on the employment multiplier would be to raise it by about 0.025, an insignificant amount in relation to the variation from other causes.

Consequently, the 1971 employment multipliers are a more accurate estimate of the employment-generating effect of pulp and paper mills than either the 1961 estimate or the estimate based on change over the period 1961 to 1971. The variation in ⎽⎽⎽mates based on 1971 data is due to uncertainty about the number of commuters, and to differences in estimates of the size of the servicing workforce.

Employment and multipliers based on both the 1971 Census of Populations and the 1971 Labour and Employment Survey underestimate the employment generating effect—the former because the census does not separate pulp and paper manufacturing from other manufacturing, and the latter because it underestimates the servicing workforce. For this reason, the most reliable employment multipliers are obtained by combining the census assessment of the servicing workforce with the measurement of the manufacturing workforce in the labour and employment survey.

If it is assumed that all the commuters work for the pulp and paper plants and that none of their servicing requirements are met in Kawerau, the employment multiplier (calculated by dividing Kawerau's workforce by the number employed in the pulp and paper mills and associated sawmill) ranges between 1.49 and 1.52, depending on which assessment of the number of commuters is used. The employment multipliers are more sensitive to the assumption that commuters are serviced by towns other than Kawerau. If 30% of the commuters were serviced in Kawerau, the local employment multipliers would drop to 1.45 and 1.46, respectively.

Some of the employment-generating effects are likely to occur within the region but outside Kawerau, although the isolation of the town would tend to minimise this. An employment multiplier of between 1.45 and 1.50 is therefore likely to be a fair estimate of the local employment-generating effects of a pulp and paper industry at Kawerau. The lower estimate of 1.45 may be thought of as the localised effect on the immediate town, and the higher estimate of 1.50 as an assessment of the effect on the surrounding region.

Using these Local Employment Multipliers

The employment multipliers derived here (1.45 to 1.50) for a pulp and paper mill fall within the range 1.45 to 1.75 calculated by Greig (1971) for a pulpmill in Scotland, and within the range (1.36 to 1.75; mean 1.55) of estimates by Reilly (1974) for a forest and forest industry complex in Queensland, Australia.

All these multipliers are based on the assumption that the need for servicing created by the establishment of a pulp mill is satisfied by the creation of new servicing jobs. In the case of Kawerau this is necessarily true since the town was established as a base for the pulp and paper industry. However, many of the future forest processing plants will be based on an existing rural community.

In a study of industrial development in five counties in Kentucky, United States, Garrison (1972) found that most of the income-generating effect was on the incomes of existing employees, proprietors, and property owners. For the 1177 industrial jobs created, only 98 new servicing jobs were created; that is, the employment multiplier was 1.08 although the income multipliers ranged from 1.3 to 2.0.

A similar effect could be expected from the establishment of future forest processing industries in New Zealand. When a pulp mill is established in an area where there has been either a stable or a declining population, there is likely to be a considerable amount

of under-employment in the servicing industries. Consequently, many of the new servicing requirements will be met by increased productivity of the existing servicing workforce.

In a survey of the effect of industrial development in Tennessee, United States, Ruttan (1955) found that increased "off-farm" jobs by members of farm families were more important in raising the income level of those families than increased labour productivity on the farm.

At Kawerau 20-30% of the workforce commutes, and is drawn from the existing population of the surrounding region. The labour turnover of this section of the workforce is high and for the most part they take unskilled positions, frequently in the sawmill. It is probable that some of the commuters accept mill employment as "fill in" seasonal work and/or as a method of increasing a family income which previously provided a low though acceptable standard of living (Whitelaw, 1961). Thus it appears that in Kawerau between 10 and 20% of the jobs provided directly in the pulp and paper mills (including the sawmill) may be used to increase the average level of income without resulting in an increase in the total employment of the region. This factor alone would reduce the estimates of the employment multiplier from between 1.45 and 1.50 to between 1.25 and 1.40.

Because any under-employment in an area affects the number of new positions created in a pulp mill and in the servicing industries, employment multipliers based on Kawerau, which was a new town established for the industry, may be misleading. A more realistic assessment of the employment multipliers associated with the establishment of a pulp and paper mill in an area would be between 1.1 and 1.4. Only under exceptional circumstances—where a new town is created, where the new workforce is a high portion of existing employment, or where there is considerable under-employment in a region—will the multipliers lie outside this range.

The low values of the employment multipliers derived here should not be used to minimise the considerable effect of the pulpmill on local economic well-being. Quite apart from the effect on population, the introduction of additional sources of income to a region enables it to share in the nation's economic growth instead of falling behind. Combined with some population growth, this enables local communities to provide more of the higher-order services and facilities.

CONCLUSIONS

Local employment multipliers for pulp and paper mills can be used to compare the local employment impact of pulp and paper manufacturing with that of alternative forest utilisation schemes, including log exports. They are not relevant to a comparison with non-forest industries unless the forest is already established. Local employment multipliers evident in the pulp and paper mills in Kawerau have been assessed at between 1.25 and 1.40.

Since present afforestation policy largely provides for future major forest schemes and utilisation in the more depressed areas of the country, the local employment impact of future utilisation plants is likely to be less, and local employment multipliers are likely to fall within the range 1.1 to 1.40. Thus, the employment impact of future export-based pulp and paper industries is likely to be much lower than earlier supposed.

However, employment multipliers do not assess the impact on regional incomes

and this appears likely to be more important than the effect on local employment. For this reason more emphasis should be placed on local income multipliers in assessing the impact of industrial development on the local communities.

ACKNOWLEDGMENT

REFERENCES

DEPARTMENT OF LABOUR 1971: Industrial information bulletin. **Labour and Employment Gazette 22(2):** 63.

DEPARTMENT OF STATISTICS 1966: "Inter-industry study of the New Zealand Economy 1959-60. Part 3: Transactions between 44 Productive Industries and Derived Tables". Government Printer, Wellington.

────── 1973a: "New Zealand Industrial Production 1970-71". Government Printer, Wellington.

────── 1973b: "New Zealand Census of Population and Dwellings 1971. Volume 4: Industries and Occupations". Government Printer, Wellington.

────── 1973c: "New Zealand Census of Population and Dwellings 1971. Supplement No. 3: South Auckland-Bay of Plenty Statistical Area". Government Printer, Wellington.

────── 1975: "Inter-industry Study of the New Zealand Economy 1965-66. Part 2: Input-output Transactions and Derived Tables". Government Printer, Wellington.

ELKAN, P. G. 1972: Industrial protection in New Zealand 1952 to 1967. **N.Z. Inst. Econ. Res., Tech. Memorandum 15.**

FENTON, R. 1972: Economics of radiata pine for sawlog production. **N.Z. J. For. Sci. 2(3):** 313-47.

FERGUSON, I. S. 1972: Wood chips and regional development. **Aust. For. 36(1):** 15-23.

FLETCHER TIMBER COMPANY 1975: Tairua and other state forests; proposals for wood purchase. Unpubl.

GARRISON, C. B. 1972: The impact of new industry: An application of the economic base multiplier to small rural areas. **Land Economics 48(4):** 329-37.

GREIG, M. A. 1971: The regional income and employment multiplier effects of a pulpmill and a papermill. **Scot. J. Pol. Econ. 18(1):** 31-48.

ICHIKAWA, Hiroya 1971: Import reliance, import substitution and the pattern of growth in New Zealand manufacturing, 1954/55-1965/66. **N.Z. Inst. Econ. Res., Res. Pap. 18.**

KAISER, H. F. and DUTROW, G. F. 1971: Structure and changes in the southern forest economy 1958-1967; **U.S. For. Serv., Sth. For. Exp. Sta., Res. Pap. 50-71.**

NEW ZEALAND FOREST SERVICE 1975: "Forestry Development Plan for Otago Planning District". Government Printer, Wellington. 49 pp.

REILLY, J. J. 1974: Impact of softwood plantations on rural economic development in Australia. **Aust. For. 37(2):** 142-52.

RUTTAN, V. W. 1955: The impact of urban-industrial development on agriculture in the Tennessee Valley and the Southeast. **Proceedings of the Regional Science Association Vol. 1:** 171-87.

WHITELAW, J. S. 1961: "A Survey of Kawerau; its Present and Future Development". Tasman Pulp and Paper Company. 92 pp (unpubl.).