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Oregon State University
School of Business

Studies in Management and Accounting for the

FOREST PRODUCTS INDUSTRIES

Pool Log Transfer System

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INTRODUCTION

The purpose of this monograph is to describe a cost system for allocating log development costs to different types of operating mills from a common source. Primarily the system collects all costs into a "pool" for subsequent allocation based on estimated grade and specie to be recovered from a specific logging operation. Pool log transfer system is a synonym for the more complex phrase, pooled log costs transferred to an operating mill. The system was devised for use in the western United States, where most companies in the forest products industry lack a sufficient fee timber base to sustain their level of operations and, therefore, are dependent upon purchases of raw material from third parties.

The raw material purchases generally consist of contractural rights to remove large volumes of timber over a period of time ranging from two to five years. Because the time from actually acquiring the cutting rights to removing the timber stand so long, companies undertake considerable risk in predicting market levels and operating costs. When a company is operating in a multiplant environment, the risks are compounded because of the mills' different operational costs and end-product markets. Thus it is more challenging to provide the proper mix of logs to each mill from a common source.

To reduce risk and effectively bid for the timber, there must be some means of allocating estimated costs to the various mills so that end-products costs can be determined. It is the impact on end-product costs that creates the greatest problem of cost allocation in a multiplant operation. The problem of allocating cost from a common source to different mills is intensified when corporate management uses divisional profits to measure the performance of operating management. The pool log transfer system was designed to solve these problems.

The system is one of traditional cost accounting. It emphases cost allocation based on relative market prices in a way that deals with the "real life" problems of timber purchases.

The system provides a means for:

- pricing various stages of inventories,
- managerial controls,
- measuring operating effectiveness, and
- supplying relevant data for decision making.

In the first part of the monograph a case study describes how a hypothetical forest products company developed the pool log transfer system. The study will show how the company's accounting system evolved from a simple average method of costing raw materials to a detailed system of cost allocation by specie and grade for each logging operation.

The last part of the monograph attempts to analyze the case study. It points out advantages and disadvantages that may help companies in the forest products industry to develop similar systems of cost allocation. The analysis will deal with both theoretical and practical aspects of the system.

CASE STUDY

Prior to the development of the pool log transfer system, the company had two operating mills, a sawmill and a paper mill. The sawmill was designed and operated as a dimension mill requiring a log mix of essentially two species (Douglas Fir and Hemlock) of sawmill grades. The paper mill operated a wood room, which used the pulp logs developed from sawmill logging operations. The wood room production was supplemented by whitewood residuals developed by the sawmill. During this period, purchased stumpage per thousand board feet was approximately $40 for Douglas Fir and $15 for Hemlock. Pulpwood stumpage cost was either nominal—$1 per thousand board feet—or was not assessed. The primary function of the timber buyers was to provide an adequate

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source of log mix for the dimension mill at an average cost that would maximize the lumber profits.

The system used to account for log costs was a simple averaging technique, which included all out-of-pocket expenditures for delivering the logs to the respective mills. The costs generally consisted of stumpage or fee depletion, road amortization, logging, and hauling. In each accounting period the company arrived at an average available cost by adding the footage, by specie, received at the mill and the related costs to beginning inventories. This average available cost was used to price ending inventories and determine the cost of logs consumed in operations. The company used the moving average technique because it was simple, management had no need for further cost refinement, and all logs were generally consumed internally.

The company purchased two additional operating units, a plywood mill and a high-grade cutting mill. The company was then faced with the problem of supplying raw materials to sawmill, plywood mill, and paper mill operations located at varying distances from the raw material sources. Each mill would operate most efficiently with differing mixes of log species, grades, and sizes: one truckload of logs from a logging operation might be suited for dimension lumber, whereas another might be better suited for being peeled into veneer at the plywood mill. The timber buyers' objective—"to place the right log at the right place at the right price"—was harder to achieve than they had anticipated. It often included searching out timber stands that would accommodate all types of mill operations. This search process, at times, ended with longer hauls to certain mills than could be cost justified. Development costs were greater than the cost of local, available raw materials. As a result, more outside log sales were necessary to profitably dispose of unwanted species and grades that could not be economically delivered to an operating mill.

Development of the System

Corporate management used the operating mill's profits to measure an operating manager's effectiveness. Because of this requirement to measure mill efficiency, management needed to design a system that would allocate the cost of the raw material to the various using mills.

The moving average method of log costs would not satisfy management requirements because of the inequitable measure of log costs among the various mills. The demand for higher grade and old growth logs brought higher stumpage and development costs, which increased the average log costs. The market prices of end products from the different types of mills were highly variable. Operating profits for the cutting sawmill and th plywood mill were very high, but profits in the di mension sawmill, the paper mill, and log sales to others decreased substantially. Obviously, there was a need for a fair measure to each operating unit.

The Agreed Base Log Price

In determining a fair measure, management agreed to use the relative market method as a proper cost allocation procedure. Further, because both high and low grade operating units used logs from the same sources, the degree of allocation was to be refined to the specie and grade level. These were the easiest decisions to make. The major problem was the determination of market values. Should market be defined as the stumpage price paid plus development costs or as a composite of these prices? This question presented three problems. First, bidding practices heavily influenced the reliability of stumpage as an indication of relative market values. Sometimes, for example, the seller would hold all but one specie at advertised prices and thus allow buyers to bid up only the one specie. Second, although stumpage indicated only a specie market, management had de creed the allocation would be to a grade leve Third, some felt that the market price should include hauling costs; others believed it should reflect only stumpage and development costs to the truck.

With these problems in mind, the company looked to published market indicators. It developed indices, which it reviewed and adjusted according to forestry personnel's judgment of market conditions. As a benchmark, the relationship of end-product market values was used to determine the reasonableness of the final product. Because hauling costs were entirely dependent upon distance traveled, the company decided to exclude those costs from the market values. The final step, and probably the most important of the entire process, was the review of the prices by the various operating managers and their agreement as to the values. This final step concluded with the establishment of the "agreed base log price."

Development of the Raw Material Costs

The next steps in development of the system were to identify the various types of information that would be necessary to effect a proper allocation and to review the accounting requirements f accumulating the necessary data.

To implement the relative market method using agreed base log prices, the company had to estimate the specie and grade mix of each purchase. This information was provided by the timber cruiser, who has the best knowledge of the probable grade recovery in the timber stand. The road engineer and logging contract supervisor provided current cost information about road building and maintenance, logging operations, and hauling.

(Although most of the significant costs are fixed by contracts, the volume factors depend on the timber cruiser's accuracy. His estimates may substantially affect the final results.)

Once the estimated raw material costs were determined, the estimated pool log transfer rates could be calculated. The estimated percent of grade within each specie was obtained from the timber cruise, and the grade volume was calculated. The grade volume was then related to total volume; this provided the weighting factor that was applied to the agreed base log price. The summation of the products provided the weighted average base log price. This was related to the per thousand estimated raw material cost. The resulting ratio was multiplied times each applicable agreed base log price to arrive at the estimated pool log transfer rates.

The next step in the development of the system was to provide a means for determining the source of a load, its ultimate destination, and application of the proper transfer rates.

By centralizing the timber accounting function, the company could consolidate all scale certificates, enter them into the records at one location, and indicate both the source and destination of the log volume. Because this would entail a high volume of transactions, the system was well suited for machine processing. Coding structures were initially established for each grade within each specie. However, with the continual expansion of grade classifications by scaling bureaus came the need to summarize detail grades to a fixed set (generally peelers, the four primary saw-log grades, utility, and hardwoods).

In each accounting period, the recorded data was summarized by logging contracts and delivery location. To determine total pooled log costs to be transferred to each mill and to cost of log sales, the company then applied the transfer rates to the grade and specie volume within each delivery location. The following example illustrates the application of the system.

Assume that A Timber sale is offered for sale by the U. S. Forest Service. A mixed specie stand requires main road construction and the use of other roads to access the sale area. The following data are provided by the Forest Service:

Cruise

Specie	Volume (MBF)	Advertised Price	Amount
Douglas Fir	4,350	$170.00	$ 739,500
Hemlock	2,250	55.00	123,750
Noble Fir	2,050	170.00	348,500
Spruce	500	55.00	27,500
Cedar	750	55.00	41,250
Total	9,900		$1,280,500

Road credits:	$248,000
Road Maintenance Fees:	$2.80/MBF
Road Use Fees:	1.90/MBF
Slash Disposal:	9.80/MBF
Erosion Control:	.50/MBF

Assume further that the company developed the following data about the sale:

Cruise

Specie	Volume (MBF)
Douglas Fir	5,860
Hemlock	1,430
Noble Fir	2,300
Spruce	760
Cedar	500
Alder	750
Total	11,600

Grade Distribution Percentage

	Grade				
Specie	#1 Peeler	#2 Peeler	Spec. Mill	#2 Saw	#3 Saw
Douglas Fir	10%	15%	25%	30%	20%
Hemlock		4	18	33	45
Noble Fir	1	3	11	30	55
Spruce			20	40	40
Cedar				50	50

Also assume that, for bidding purposes, the U. S. Forest Service has frozen the advertised price on all species except Douglas Fir and Noble Fir. After evaluating the various attributes of the sale, management decides to bid a maximum of $355/MBF for Douglas Fir and Noble Fir. It is the successful bidder for that amount.

Total road building costs to access the timber stand are estimated to be $300,000. Contracted logging costs are $55/MBF, and scaling fees will approximate $2/MBF.

Exhibit I indicates that the total estimated cost of the purchase to the truck will be $3,894,196. Exhibit II shows the allocated cost of each grade log that will be applied as actual volume is delivered to the various consuming mills and to outside log sales. Utility and hardwood species are assigned rates set at the logging costs of $55/MBF.

EXHIBIT I

ESTIMATED COST OF LOGGING A TIMBER PURCHASE

	Douglas Fir and Noble Fir	All Other Coniferous Specie	Total
Stumpage	$ 355.00	$ 55.00	
Slash Disposal	9.80	9.80	
Erosion Control	.50	.50	
Road Maintenance	2.80	2.80	
Road Use Fees	1.90	1.90	
Road credits ($248,000/10,850)	(22.86)	(22.86)	
Road Amortization ($300,000/10,850)	27.65	27.65	
Logging	55.00	55.00	
Scaling	2.00	2.00	
Administration	1.50	1.50	
	$ 433.29	$ 133.29	
Estimated Volume	× 8,160	× 2,690	10,850
Total Est. Cost	$3,535,646	$ 358,550	$3,894,196

EXHIBIT II

CALCULATION OF POOL LOG TRANSFER RATES

Specie	Grade	%	Volume (MBF)	% to total	Agreed Base Log Price	Weighted Average	Transfer Rates
D. Fir	#1 Peeler	10	586	5	$400	$ 20.00	$639
	#2 Peeler	15	879	8	350	28.00	559
	Spec. Mill	25	1,465	14	270	37.80	431
	#2 Saw	30	1,758	16	250	40.00	399
	#3 Saw	20	1,172	11	180	19.80	287
		100%	5,860				
Hemlock	#2 Peeler	4	57	1	215	2.15	343
	Spec. Mill	18	257	2	195	3.90	311
	#2 Saw	33	472	4	180	7.20	287
	#3 Saw	45	644	6	155	9.30	248
		100%	1,430				
Noble Fir	#1 Peeler	1	23	1	250	2.50	399
	#2 Peeler	3	69	1	215	2.15	343
	Spec. Mill	11	253	2	195	3.90	311
	#2 Saw	30	690	6	180	10.80	287
	#3 Saw	55	1,265	12	155	18.60	248
		100%	2,300				
Spruce	Spec. Mill	20	152	1	175	1.75	279
	#2 Saw	40	304	3	160	4.80	256
	#3 Saw	40	304	3	125	3.75	200
		100%	760				
Cedar	#2 Saw	50	250	2	240	4.80	383
	#3 Saw	50	250	2	175	3.50	279
		100%	500	100%		$224.70/MBF	
	Total Volume		10,850				
Average Estimated Cost ($3,894,196/10,850 MBF)						$358.91/MBF	
Ratio ($358.91/$224.70)						1.597	

Controls

To establish control over the system, management specified that actual costs and pool log transfer costs would be collected in separate accounts. This established a set of variance accounts.

Using the data from Exhibits I and II and assumed volumes, Table I and II show what the transferred costs might be to the cutting and dimension mills for a given accounting period, the actual out-of-pocket expenses, and the resulting variance created in the accounts. Note that the cutting mill that received higher grade logs was allocated a greater relative share of the costs. Similar accounts would be maintained for each of the other mills. To evaluate the accuracy of the data, the variance accounts for each mill were combined (Table III).

To aid in analyzing variance accounts, the logging contract supervisor periodically reviewed logging sites and reported the estimated remaining volumes of specie and grade to timber management. The most common problem found by analyzing variances was a significant difference between the actual grade recovery percentage and the estimate. On large logging operations with divergent terrain and specie stands, significant variances at the beginning of actual removal would often reverse themselves near the end of the logging. This was apparent, for example, when initial logging would begin in a high-grade Douglas Fir stand and move downhill into creek beds of predominantly Cedar and Alder. Although very high transfer costs would be associated with the Douglas Fir, in contrast to nominal costs for Alder, actual out-of-pocket stumpage and logging would be relatively constant for all specie.

Analysis of the combined variances in Table III requires an initial adjustment for the difference in road credits. The transfer rates include road credits, which have been spread over the total volume of the purchases on a straight line basis. In the example the amount is $22.86/MBF. The U. S. Forest Service accounting method, in contrast, applies road credits to stumpage charges based on the percentage of road that has been built and has met the required specifications of the contract. Hence, included in the variance is $71,302 representing the difference in the two methods of accounting (4,565 MBF $\times$ $22.86 – $175,658 = $71,302). The remaining balance of the

TABLE I

Cutting Mill Log Cost Transfer

Specie	Grade	Volume	Transfer Rate	Transfer Amount	Actual Rate[1]	Actual Amount	Variance
Douglas Fir	#2 Peeler	8	$559	$ 4,472	$454.65	$ 3,637	$ 835
	Spec. Mill	210	431	90,510	454.65	95,477	(4,967)
	#2 Sawmill	246	399	98,154	454.65	111,844	(13,690)
Hemlock	Spec. Mill	12	311	3,732	154.65	1,856	1,876
	#2 Sawmill	132	287	37,884	154.65	20,414	17,470
Spruce	Spec. Mill	110	279	30,690	154.65	17,012	13,678
Cedar	#2 Sawmill	20	383	7,660	154.65	3,093	4,567
Noble Fir	Spec. Mill	21	311	6,531	454.65	9,548	(3,017)
	#2 Sawmill	115	287	33,005	454.65	52,285	(19,280)
		874		312,638		$315,166	(2,528)
Add road credits included in transfer rates				19,980			19,980
				$332,618			$17,452

[1] Actual Rate:

	Douglas & Noble Fir	Other Coniferous Species
Logging	$ 55.00	$ 55.00
Stumpage	355.00	55.00
Rd. Amortization	27.65	27.65
Other Fees	17.00	17.00
	$454.65	$154.65

TABLE II

DIMENSION MILL LOG COST TRANSFER

Specie	Grade	Volume	Transfer Rate	Transfer Amount	Actual Rate	Actual Amount	Variance
Douglas Fir	#2 Sawmill	126	$399	$ 50,274	$454.65	$ 57,286	($ 7,012)
	#3 Sawmill	623	287	178,801	454.65	283,247	(104,446)
Hemlock	Spec. Mill	210	311	65,310	154.65	32,477	32,833
	#2 Sawmill	380	287	109,060	154.65	58,767	50,293
	#3 Sawmill	426	248	105,648	154.65	65,881	39,767
Noble Fir	#3 Sawmill	361	248	89,528	454.65	164,129	(74,601)
		2,126		598,621		$661,787	(63,166)
Add road credits included in transfer rates				48,600			48,600
				$647,221			$(14,566)

TABLE III

COMBINED VARIANCE ACCOUNTS (ALL MILLS)

Mill	Volume	Transfer Amount	Actual Amount	Variance
Plywood	960	$ 462,720	$ 378,240	$ 84,480
Paper	483	62,307	83,885	(21,578)
Dimension	2,126	598,621	661,787	(63,166)
Cutting	874	312,638	315,166	(2,528)
Sales	122	26,875	18,997	7,878
	4,565	$1,463,161	1,458,075	5,086
Less applied road credits			175,658	175,658
Actual out-of-pocket expenses			$1,282,417	($180,744)

variance ($109,442) represents the removal of a greater percentage of high-grade logs than the other grades. This variance would not necessarily cause alarm however, since only 42 percent of the estimated volume had been removed. One could expect that the lower grade volumes would exceed the higher grade volumes in the remaining 58 percent of the volume and that the trend of the variance would be reversed. In the example the field forester would have to closely monitor grade and species recoveries to ensure that a problem was not developing. Both differences in the location of specie and grade and selective grade logging practices also made it important to have a field review before contemplating adjustment for variances.

When adjustments became necessary, the question arose as to what type of adjustment to make—prospective for the remaining life of the logging operation or on a year-to-date basis? As the number of logging contracts increased, so did the number and magnitude of the adjustments. This problem was caused primarily by the increase in the volume of transactions. The more time spent on recording, the less time there was available for adequate variance analysis. Therefore, variances were generally not investigated until the amount became large and a problem appeared imminent. Because variance adjustments were treated as year-to-date adjustments, operating results from period to period would show, at times, significant swings in log costs. This made forecasting of operations difficult and analysis of actual performance time-consuming. To mitigate the effect of the adjustments and thereby allow more predictable operating results for each mill, management concluded that the adjustments should be made prospectively over the remaining life of the logging contract. In 1974 this decision was modified to conform with the provisions of Accounting Principles Board Opinion No. 28. Materiality of an adjustment became the deciding factor. If the amount was material, the adjustment was recorded on year-to-date basis. If not, the pool transfer rates

were changed to effect the adjustment prospectively.

The system was now complete, and all objectives had been met: the timber buyers had a tool to aid them in acquiring timber and timber cutting rights, operating management had a more equitable allocation of raw material costs, and corporate management had the means for measuring certain facets of each mill's operations.

ANALYSIS

The case study presents a method of raw material cost allocation in a multiplant situation. Theoretically, this cost allocation method appears to be superior to the simple average cost method. However, for practical application the system has both strengths and inherent weaknesses.

The system described in the case study was designed for forest industry operations in the western United States, where timber purchases are often made at large government sales involving several species. Applying the case study system to a company operating in the southern United States, where a large number of relatively small purchases from third parties is more normally the situation, may prove to be impractical in terms of both computer and manpower capabilities. In that case the cost may far outweigh the anticipated benefits that enhancement of cost allocation might provide.

The environment in which the case study company operated has changed dramatically. The cost of the basic raw material, logs, has increased substantially as a percentage of the total cost of the end product. When the case study company had only two operating mills, the cost allocation consideration was one of byproduct costing. This is because the saw log costs were incurred for the dimension mill, whereas pulp logs, a byproduct of logging operations, were used in the paper mill. In this situation the simple average costing method was responsive to management's information needs. However, as the company expanded its operations in both products and types of mills, management was faced with the need for determining the operating efficiency, non-raw material cost structures, and relative profitability of the various mill operations. In response to this changing environment, the company devised the pool log transfer system.

To measure the effectiveness of a mill manager, management decided to use relative market values as the basis upon which to allocate log costs. However, it decided that market values would not be adjusted for hauling costs. Hauling costs were treated as incremental costs. Therefore, it was possible for a particular mill's operations to be adversely affected as a result of incurring high hauling costs from a logging operation located at a remote distance from that mill. From a practical standpoint, treating hauling as incremental costs allowed management to sell in the open market logs that were destined for a remote mill and to purchase logs from operations closer to the mill location. The decision to exclude hauling costs, therefore, is both theoretically and practically justified and, in fact, it enhanced the system.

One of the basic premises of any management information system is that managers should be evaluated only on decisions that are under their control. In this case, mill managers had little control over the timber purchases and should not have been evaluated on the results of that process. Theoretically, the transfer price of logs to the operating mills should be on the basis of current market values, and the difference between cost and market should be allocated to a separate cost center. Insofar as cost allocation is based upon relative market values, the pool log transfer system satisfies this requirement. To the mill managers it makes little difference whether a log comes from sale *A* or sale *B*. What matters is whether the log is a #1 Douglas Fir peeler or a #2 Hemlock sawlog, for the mill manager bases his decisions on the value of the end product that can be made from that log, not its original cost. Perhaps a budgeting process that fully considered each accounting period, each mill, total log source, and estimated hauling costs could enhance the system.

The pool log transfer system requires an estimate of the total cost of a logging operation. As noted in Exhibit II, the most significant factor is estimated volume developed from the cruise. Therefore, the costs derived from the system are inherently only as valid as the accuracy of the initial cruise or subsequent recruises. The case study notes that the most common problem found in analyzing log cost variances was that the actual grade recovery percentages were significantly different from the estimates. As the number of logging contracts increased, the time required to analyze the log costs variances also increased. Therefore, the possibility of significant lags in variance analysis and adjustment exists. By treating cumulative variance adjustments as year-to-date adjustments, operating results from period to period could show, at times, significant differences in log costs, this could make forecasting of operations difficult and analysis of actual performance time consuming.

It is apparent from the case study that the time required to control the system is directly proportionate to the number of individual purchases. For example, the system requires specific information about each logging operation. Cruise data, percentage of grade distribution within each specie, estimated total cost of delivering the timber to the mills, and the calculation of the pool log transfer rates are the primary pieces of information required by the system. In addition, the record-keeping system must provide information about both the source and the destination of the raw material by grade and specie. Therefore, as the number of logging operations and operating mills increase, the controls necessary to effectively monitor the system must become more comprehensive. Furthermore, as the increasing volume of purchases and number of mils begin to tax the capacity of the system, the internal control features may be sacrificed. For these reasons, the case study system may be suited primarily for forest products companies operating in the western United States, where they typically make purchases in larger individual units.

The data input requirements together with the variables involved lend themselves more readily toward an automated data processing system than a manual system. Although the pool log transfer system can be operated manually, manual operation becomes more difficult and may be less cost justified as the number of logging operations and operating mills increase.

Summary

The cost allocation system described in the case study is innovative and appears to be theoretically sound. Although the cost/benefit relationship needs to be evaluated separately for each company that is considering such a system, it appears from the example that the system is flexible enough to be able to stop at the specie level or to be refined at the grade level. The system could also avoid an evaluation by grades if set transfer prices were established and the timber department were organized as a separate profit center. This, in turn, would allow mill managers and timber managers to be evaluated on their own merits.

Even though the pool log cost system may have some weaknesses, it has introduced two major elements into modern timber companies' costing systems. These are:

- The system develops all the basic information necessary to evaluate a timber purchase: species and grade mix of each purchase and cost data.
- The system recognizes two basic facts: that different logs are suited for different end uses and that the value of a log is based upon the value of the end product.

Cost justification of the system would depend on the need for the additional data provided about timber purchases and the significance of the noted weaknesses.

Monographs published to date:

"The Rush to LIFO: Is it Always Good for Wood Products Firms?" issued in December 1974 and published in condensed form in the April 1975 issue of *Forest Industries*

(This monograph was revised and reissued in January 1976).
"Accounting and Financial Management in the Forest Products Industries: A Guide to the Published Literature," issued in June 1975.

(A supplement to this monograph was issued in March 1977.)
"A Decision Framework for Trading Lumber Futures," issued in October 1975.

"Capital Gains Tax Treatment in the Forest Products Industries," issued June 1976.

"Measurement Difficulties in the Log Conversion Process," issued June 1977.

"Capital Budgeting Practices in the Forest Products Industry," issued March 1978.

"A Reporting and Control System for Wood Products Futures Trading Activities," issued July 1978.

"Selected Issues of Financial Accounting and Reporting For Timber," issued November 1978.

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