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# **Studies in Management and Accounting for the FOREST PRODUCTS INDUSTRY**

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**STUDIES IN MANAGEMENT AND ACCOUNTING FOR THE  
FOREST PRODUCTS INDUSTRY**

**A SURVEY AND ANALYSIS OF COST-TO-VALUE ALLOCATION  
PRACTICES OF SOLID WOOD PRODUCT MANUFACTURERS**

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# **COST-TO-VALUE ALLOCATION PRACTICES OF SOLID WOOD PRODUCT MANUFACTURERS**

## **Introduction**

This monograph describes the concept of allocating aggregate costs of logs, wood, and manufacturing to specific products based on those products' relative market values. It includes results of a survey and a general analysis of the issues involved.

The question is relevant because of the following inherent characteristics of logs, lumber, veneer and plywood and other secondary manufactured products:

- A market exists for the wood, in whatever form, from the beginning to the end of the manufacturing process; i.e., markets exist for logs, cants, flitches, green lumber and veneer, dried lumber and veneer, rough and surfaced lumber, unsanded and sanded plywood and chips.
- The market price varies according to botanical and physical characteristics; i.e., price depends on species, grade, size and structural integrity.
- Management usually has the option of producing for several or all of the markets and can change that choice as markets suggest.

Purchase prices of material and manufacturing might not vary significantly because of species, grades, sizes or structural integrity. For example, while species and grade are usually factors in aggregate prices paid for logs, those characteristics are usually estimated and not precisely defined until later in the manufacturing process.

Cost accounting based solely on aggregate cost and volume does not, at least economically, equate costs of specific products with market value. This suggests that management could benefit from information based on changes in product value from initial purchase to eventual sale. Costs allocated on that basis would also affect the accounting measure of investments in timber resources, inventories, and cost of sales.

Although the authors were aware that some companies were allocating aggregate costs based on product value consideration, the principal hypothesis was that such practices were not typical. Accordingly, the authors conducted a survey to test the hypothesis.

The principle of allocating costs based on inventoriable asset values is hereinafter referred to as "cost-to-value allocations."

## **The Survey**

During the last quarter of 1991, twenty-five forest products companies located in northern California, Idaho, Oregon, and Washington were asked to complete a questionnaire to determine the cost allocation methods currently in use. Nineteen of the firms responded. A copy of the questionnaire is shown as an appendix. The returned questionnaires indicate both similarities and differences in cost allocations.

The questionnaire asked about methods used to allocate costs to logs, both from fee and public sources. It also inquired about allocation of manufacturing costs to products and the methods of allocating wood costs to the finished

products of lumber, veneer and plywood.

Results of the survey are shown in tables that will be displayed in the appropriate discussions that follow. Rows of the tables contain the responses to a specific question of the questionnaire. The question number is shown in the first column of each table. Questions are briefed at the extreme right of each table.

### Results of Survey

The survey indicates that cost-to-value allocations are common at various intermediary phases of the conversion process. However, it appears allocation through all phases is not typical. This suggests the concept is conceptually valid, but comprehensive application may be affected by practical limitations on obtaining timely information about product characteristics, other complexities and questions about relevance.

## **STUMPAGE, DEPLETION & LOGGING**

Stumpage costs from government timber sales: Fundamentally, there are two possible approaches to measuring costs of stumpage. One approach is to equate costs with the amounts billed. Since the amount billed is based on contract rates, and the contract rates are heavily biased to the bid species, periodic billings will not, by definition, represent the value of logs.

The other approach is to allocate cost based on the value of what was received. The allocation could be representative of the estimate (of

volume and value) which the company used in its successful bid. On this basis, the allocation could essentially track the outcome of the estimates and provide management with information about the accuracy of the original estimates (which probably considered log grade, species and volume).

Cost-to-value allocation based on log grades/species tends to be most relevant when certain logs are sold or are identified with specific manufactured products.

Methods of cost allocations used in allocating costs to logs by the companies responding to the survey are summarized in Table 1. Companies manufacturing lumber exclusively are arranged in the left portion of the table. Those that manufacture lumber, veneer and plywood are arranged in the right portion under the heading "Full Line." The one firm manufacturing plywood only is shown in the center column labeled "Plywood."

For each category, the number of firms responding is shown in the first row of the body of the table. The columns identified by an "n" show the number of those firms replying in the affirmative. The column identified by the "%" sign calculates the percentage of positive responses within the category. Since there was only one plywood-only firm, the "%" column was omitted. The "TOTAL" column totals the positive responses across all 19 returned survey forms and shows the percentage of positive responses.

Table 1: Allocation of costs to logs

Qst	LBR MFGRS		PLYWOOD	FULL LINE		TOTAL		Question content
#	n	%	n	n	%	n	%	
	12	100%	1	6	100%	19	100%	Total number of firms reporting
								<u>LOGS FROM USFS, BLM, etc.</u>
1	8	67%	1	3	50%	12	63%	Stumpage cost portion of delivered log cost based on rates specified in contract?
2	5	42%		2	33%	7	37%	allocated based on log species?
3	1	8%		2	33%	3	16%	allocated based on log grade?
4	3	25%		3	50%	6	32%	allocated based on company appraisal made:
5	2	17%		0	0%	2	11%	-for basis of bid price?
								-at a later time?
6	12	100%	1	5	83%	18	95%	Cutting and transportation costs allocated to logs
7	0	0%		1	17%	1	5%	- based solely on volume?
								- based on concepts of relative log value?
8	3	25%		0	0%	3	16%	As periodically measured, is the carrying amount of log inventory
9	3	25%		0	0%	3	16%	- based on specific identification of log sources
10	0	0%		1	17%	1	5%	- is it each specific source?
								- some grouping of log source?
11	7	58%		4	67%	11	58%	- based on overall averages of delivered log costs
12	3	25%	1	2	33%	6	32%	- FIFO time frame?
								- longer time frame?
								<u>LOGS FROM FEE PROPERTIES</u>
13	9	75%		4	67%	13	68%	Is depletion based on:
14	2	17%		2	33%	4	21%	- volume only?
15	1	8%		0	0%	1	5%	- relative values of timber?
								- relative values of delivered log?
16	11	92%		5	83%	16	84%	Are cutting and transportation costs allocated to fee logs
17	0	0%		1	17%	1	5%	- based solely on volume?
								- based on concepts of relative log value?
18	4	33%		3	50%	7	37%	As periodically measured, is the carrying amount of log inventory
19	7	58%		5	83%	12	63%	- based on value concepts?
								- based on overall averages of delivered costs irrespective of actual composition of inventory?

Twelve companies record the stumpage based solely on the purchase prices specified in the timber sale contract. Seven companies allocated cost based on some combination of species, grade and/or company appraisal of value. Of this group, six respondents allocated based on company appraisal, generally also distinguishing between species and/or grade.

Depletion of fee properties: Thirteen of the 19 respondents measure depletion solely on the basis of volume, indicating no cost-to-value allocations. Four allocated cost based on relative values. Thus, the survey indicates cost-to-value allocation is less common for fee properties than for stumpage contracts. This tendency might result from a low cost basis of fee properties when compared to contract timber; or from the absence of necessary data, since fee logs are not necessarily subjected to the same scaling practices as contract logs.

(The survey did not request information on log transfer pricing practices. Transfer pricing usually results in measures of gain or loss to the timber operations as manufacturing is charged with a log value. Transfer pricing could result in cost-to-value allocations of manufactured products, depending on the practices for eliminating timber operation gains/losses remaining in inventory.)

Cutting and delivery costs: All but one respondent allocated cutting and transportation cost solely on volume, even if stumpage or depletion were allocated based on value. This finding was expected because costs are

generally directly dependent on volume. However, when such costs are high relative to stumpage (such as for so-called deficit sales) allocation based on value (species/grade) would better correlate with the economic justification for the investment.

## **ASSET VALUE MEASUREMENT - TIMBER AND LOG INVENTORIES**

The methods used to allocate stumpage, depletion and harvesting costs affect the valuation of the remaining investment in timber assets and log inventories. Presumably, operational cost-to-value allocations would result in corresponding cost measurements of these assets.

The survey asked if log inventory carrying values were based on cost-to-value allocations. Seven respondents answered "yes" to the question (Table 1). Thus, the survey indicates cost-to-value allocation practices are generally consistent between measuring costs of harvesting operations and determining the cost of log inventories.

The survey did not ask specifically about measuring costs of investments in timber contracts or fee properties. However, based on respondents' answers to the other questions, one could assume no more than seven of the nineteen companies would have valued those assets based on cost-to-value concepts.

The following characteristics of owning and harvesting a typical contract or fee investment can result in unreasonable cost allocations if value concepts are not used:

- The net cash investment (including roads) during the investment term does not earn interest;
- The bid prices are skewed because of differences in estimates of volumes for specific species;
- Periodic harvesting is selective as to species;
- The logging and hauling costs of cull material is more or less than cull log values, and there could be an option of leaving cull logs in the forest;
- The contract bid price is not directly sensitive to log grades, and the "bid species" is the significant multiplier in determining the highest bidder;
- Continuing changes in allowable logging practices on fee property extends the investment period and might result in patchwork patterns of stands which vary as to value.

Based on the survey, sixteen companies allocated manufacturing costs to products based solely on volume. Four companies reported that departmental costs were allocated based on the relative manufacturing complexities of both plywood and lumber products.

## MANUFACTURING COSTS

**Table 2: Allocation of manufacturing costs**

Qst #	LUMBER MFGRS		PLYWOOD	FULL LINE		TOTAL		Question content
	n	%	n	n	%	n	%	
	12	100%	1	6	100%	19	100%	Total number of firms reporting
20	10	83%		6	100%	16	84%	MANUFACTURING COSTS Are departmental costs allocated to prime products based on:
21	0	0%		0	0%	0	0%	- volume only?
22	2	17%	1	1	17%	4	21%	another allocation of cost: - relative values of end product? - relative manufacturing complexities?

The relevance of allocating manufacturing costs based on factors other than simple volumes depends on the product variability. For example, a stud mill is likely managed to produce a high volume of stud grade

"2 x 4's" and "2 x 6's" (maximum length, 8 feet) from No. 3 saw logs. Value variations in both the logs and lumber might not be significant. Conversely, a typical cutting sawmill can manufacture lumber of various

sizes, and grades, depending on the log characteristics. Value variations in both logs and lumber are probably significant. Also, management can elect to saw for grade rather than size, resulting in a recovery loss but higher end-product values. Other examples are:

- Quarter sawn vs. flat sawn lumber;
- Boards vs. dimension lumber;
- Shop vs. structural lumber;
- Peeling thicker vs. thinner veneer;
- Clipping veneer for grade vs. volume;
- Laying up larger than 4' x 8' panels.

#### **ALLOCATION OF WOOD COSTS TO FINISHED PRODUCTS**

The survey indicates cost-to-value allocations for wood content are fairly common as a basis for determining the costs of finished products. Thirteen lumber manufacturers applied such concepts at the species level; of these, five also considered grade and/or size.

Of seven veneer manufacturers, four allocated wood costs based on species; of these, three also considered grade. The same seven companies manufacture plywood; five considered the value of the various veneers when measuring costs of the plywood inventories.

Thus, the survey indicates cost-to-value allocation for the wood content

of lumber, veneer and plywood products is prevalent.

Allocating manufacturing costs based on factors other than volume requires timely information that might not be available without additional costs. Although conceptually valid, such cost/benefit considerations might preclude cost-to-value allocations. The survey shows some firms allocate costs based on manufacturing complexities.

#### **BY-PRODUCT COSTING FOR CHIPS**

As a final matter of interest, the questionnaire asked how companies were allocating revenue (or wood costs) of chips. Those results are shown in Table 4. The method used appeared to depend on the industry segment. Firms that manufactured only lumber usually left the fiber content of chips in lumber.

Companies also manufacturing veneer or plywood tended to use either by-product costing or joint-product costing. Under by-product costing theory, net revenues would be used as a cost offset; under joint-product costing, some wood costs will be allocated to chips. The prevalent method appears to be by-product costing.



**Table 3: Allocation of costs to finished products**

Qst #	LUMBER MFGRS		PLYWOOD	FULL LINE		TOTAL		Question content
	n	%	n	n	%	n	%	
	12	100%	1	6	100%	19	100%	Total number of firms reporting <b>FINISHED PRODUCTS</b>
								<b>LUMBER</b>
23	4	33%		1	17%	5	26%	Is wood content of finished lumber valued on an overall simple average costs of all logs used during period?
24	8	67%		5	83%	13	68%	Is wood content of finished lumber valued based on an allocation of cost of logs used during period:
25	1	8%		4	67%	5	26%	- relative to species?
26	1	8%		2	33%	3	16%	- relative to grade?
								- relative to size?
27	8	67%		6	100%	14	74%	Is the manufacturing cost of finished lumber valued
28	1	8%		0	0%	1	5%	- based on an overall simple average of costs during period?
29	2	17%		1	17%	3	16%	- based on allocation of costs:
								- relative to values of end product?
						7	100%	- relative to manufacturing complexities?
								Total number of firms reporting <b>VENEER</b>
30				3	50%	3	43%	Is the wood content of veneer valued
								- based on an overall simple average of costs during period?
31				4	67%	4	57%	- based on an allocation of log costs used during the period
32				3	50%	3	43%	- relative to species?
33				1	17%	1	14%	- relative to grade?
								- relative to size?
34			1	6	100%	7	100%	Is the manufacturing cost portion of veneer
35				0	0%	0	0%	- based on an overall simple average of costs during period?
36				1	17%	1	14%	- based on allocation of costs:
								- relative to values of end product?
								- relative to manufacturing complexities?
								<b>PLYWOOD</b>
37				2	33%	2	29%	Is the veneer content valued
38			1	4	67%	5	71%	- based on an overall simple average cost of veneer used?
								- based on values of various veneers used in a panel?
39				5	83%	5	71%	Is the manufacturing cost portion
								- based on an overall simple average of costs during this period?
40				0	0%	0	0%	- based on an allocation of costs
41			1	2	33%	3	43%	- relative to panel values?
								- relative to manufacturing complexity?

**Table 4: Accounting for Chips**

Qst #	LUMBER MFGRS		PLYWOOD	FULL LINE		TOTAL		Question content
	n	%	n	n	%	n	%	
	12	100%	1	6	100%	19	100%	Total number of firms reporting
42	2	17%	1	5	83%	7	37%	CHIPS Net revenues of chips offset wood costs?
43	1	8%		0	0%	1	5%	Are wood costs allocated to chips?

## SUMMARY

The survey indicates the following about cost-to-value allocations:

- Seven of nineteen companies measured stumpage cost based on various value concepts of a contract or group of contracts. This is in contrast to equating stumpage cost with billings from the seller, which is the apparent practice of the other twelve respondents.
- Cost-to-value allocation is less common for depletion of fee properties. Four of the nineteen respondents used such concepts; the remaining thirteen measured depletion solely on volume.
- The preponderant practice for measuring timber harvesting and transportation costs is volume.
- Four of nineteen respondents applied cost-to-value concepts in allocating manufacturing costs.
- Seven companies used cost-to-value concepts in valuing log

inventories; twelve considered only volume.

- In determining the cost of lumber, veneer and plywood inventories, cost-to-value allocations are common for the wood content.
- Eight companies use either by-product or joint-product costing for chips; the other eleven leave the fiber cost in the prime product.

The authors believe that the value of products at various stages of manufacturing should be measured so managers have information available to make better selling or processing decisions. Relevant information is more reliable if the accounting system is designed to capture and report, in a timely manner, product value throughout the manufacturing process. An overall analysis of the survey indicates significant industry practices capable of achieving these measurements.

## APPENDIX

### Studies In Management and Accounting For The Forest Products Industry Survey Questionnaire of Direct and Indirect (Secondary) Cost Allocations

#### Introduction

Typically sawmills, veneer and plywood plants, and various secondary or remanufacturing operations use process cost systems. By definition, a process cost system identifies and classifies costs attributable to a department (function). Such costs include direct costs (specifically identifiable with the function) and indirect costs which are allocated based on various concepts of association or relationships.

Identified costs are matched with volumes to determine per unit averages. Management's use of such information includes monitoring efficiency, evaluating profitability and preparing financial reports.

Process costing concepts assume a high degree of homogeneity as to (a) raw materials, (b) manufacturing activity, and (c) end product. Some companies' process cost systems provide for allocations of direct and indirect costs within a department (function) to measure deviations from homogeneity (secondary allocations). These secondary allocations are generally based on either value or cost identification. Because value may not be evident at all stages, measurement of such changes can provide critical information. Also, for those costs which vary by specific products, secondary allocations can similarly provide important information.

#### I. Logs

##### A. From USFS, BLM and other executory type contracts-

- |  |            |    |
|--|------------|----|
| 1. Is the stumpage cost portion of delivered log costs               |            |    |
| (a) Based on rates specified in the contract?                        | yes__ no__ | 1  |
| (b) Based on another allocation of the total estimated contract cost |            |    |
| (1) Allocated based on log species                                   | yes__ no__ | 2  |
| (2) Allocated based on log grade                                     | yes__ no__ | 3  |
| (3) Allocated based on company appraisal                             |            |    |
| a. made for basis of bid price                                       | yes__ no__ | 4  |
| b. made at a later time  | yes__ no__ | 5  |
| 2. Are cutting and transportation costs allocated to logs            |            |    |
| (a) Based solely on volume   | yes__ no__ | 6  |
| (b) Based on concepts of relative log value                          | yes__ no__ | 7  |
| 3. As periodically measured, is the carrying amount of log inventory |            |    |
| (a) Based on specific identification of log sources                  | yes__ no__ | 8  |
| (1) If yes, is it each specific source                               |            |    |
| (such as a specific contract or vendor source), or,                  | yes__ no__ | 9  |
| (2) Some grouping of log source                                      |            |    |
| (such as all USFS contracts or all government contracts)             | yes__ no__ | 10 |
| (b) Based on overall averages of delivered log costs                 |            |    |
| (1) FIFO time frame  | yes__ no__ | 11 |
| (2) Longer time frame  | yes__ no__ | 12 |

<b>B. From Fee Properties</b>		
1. Is depletion based on		
(a) Volume only	yes__ no__	13
(b) Another allocation of cost		
(1) Relative values of timber	yes__ no__	14
(2) Relative values of delivered log	yes__ no__	15
2. Are cutting and transportation costs allocated to fee logs		
(a) Based solely on volume	yes__ no__	16
(b) Based on concepts of relative log value	yes__ no__	17
3. As periodically measured, is the carrying amount of log inventory		
(a) Based on value concepts as in questions I3, above	yes__ no__	18
(b) Based on overall averages of delivered costs irrespective of the actual composition of the inventory	yes__ no__	19
<b>II. <u>Manufacturing Costs</u></b>		
A. Are departmental (functional) costs allocated to prime products based on		
1. Volume only	yes__ no__	20
2. Another allocation of cost		
(a) Relative values of the end product	yes__ no__	21
(b) Relative manufacturing complexities	yes__ no__	22
<b>III. <u>Finished Products</u></b>		
A. Lumber -		
1. Is the wood content of finished lumber valued		
(a) Based on an overall simple average of cost of all logs used during the period	yes__ no__	23
(b) Based on an allocation of cost of logs used during the period		
(1) Relative to species	yes__ no__	24
(2) Relative to grade	yes__ no__	25
(3) Relative to size	yes__ no__	26
2. Is the manufacturing cost portion of finished lumber valued		
(a) Based on an overall simple average of costs during the period	yes__ no__	27
(b) Based on an allocation of costs		
(1) Relative to values of the end product	yes__ no__	28
(2) Relative to manufacturing complexities	yes__ no__	29
B. Veneer -		
1. Is the wood content of veneer valued		
(a) Based on an overall simple average of cost of all logs used during the period	yes__ no__	30
(b) Based on an allocation of cost of logs used during the period		
(1) Relative to species	yes__ no__	31
(2) Relative to grade	yes__ no__	32
(3) Relative to size	yes__ no__	33
2. Is the manufacturing cost portion of veneer		
(a) Based on an overall simple average of costs during the period	yes__ no__	34
(1) Relative to values of the end product	yes__ no__	35
(2) Relative to manufacturing complexities	yes__ no__	36
C. Plywood -		
1. Is the veneer content valued		
(a) Based on an overall simple average of cost of veneer used	yes__ no__	37
(b) Based on the values of various veneers used in a panel	yes__ no__	38
2. Is the manufacturing cost portion		
(a) Based on an overall simple average of costs during this period	yes__ no__	39
(1) Relative to panel values	yes__ no__	40
(2) Relative to manufacturing complexities	yes__ no__	41
D. Chips -		
1. Do you use principles of by-product costing, whereby the net revenues from chips is allocated as offset to wood costs	yes__ no__	42
2. If answer to 1 is no, are wood costs allocated to chips	yes__ no__	43

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