Oregon State University
School of Business

Studies in Management and Accounting for the

FOREST PRODUCTS INDUSTRIES

"MICROCOMPUTER MODELING IN THE FOREST PRODUCTS INDUSTRY

by Steven D. Reiff

MICROCOMPUTER MODELING IN THE FOREST PRODUCTS INDUSTRY

by Steve Reiff, Sandstrom, Reiff & Company

The environment in which forest product managers must operate their businesses has become increasingly uncertain. The relative stability of prior years is behind us. In its place has come extreme volatility in demand, prices, interest rates, and log costs. This volatility has been accompanied by predatory import practices and fickle government and labor behavior. On the other hand, a technology explosion is in progress which offers improved realization, recovery, and productivity within the forest products operations—for a price. How does management proactively manage with so many variables affecting its operations?

This paper discusses the general concepts of decision modeling and then presents a Repair/Replace case example.

THE NEED FOR MODELING

Modeling is one practical tool that can assist forest product managers in coping with the myriad factors that can influence operations and profit. What is modeling? Simply stated, modeling is putting a real world situation into a mathematical formulation.

Figure 1

MANAGEMENT
A Decision Making Function

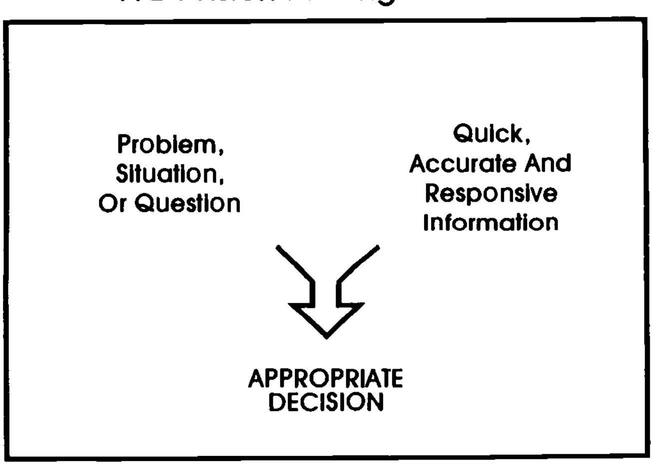


Figure 1 depicts how modeling can benefit management. As the chart indicates, forest product managers are faced with many problems, situations, or questions, such as:

STRATEGIC PLANNING ISSUES

- What is the impact of inflation on real net worth?
- With increasing output, what will working capital requirements be?
- How can the impact of a change in labor rates be clearly and quickly communicated to negotiators?
- What will be the impact of a change in government regulations?
- What is the effect of raw materials price increase on cost, demand, and operating income?

BUDGETING ISSUES

- What is the impact of increasing production to two shifts?
- At what volume level is a shut-down in order?
- How can a multi-divisional budget be revised and updated quickly and accurately?
- What will be the impact on production costs and profits if the sales mix changes?

INVESTMENT ANALYSIS ISSUES

- Should equipment be repaired or replaced?
- Which of two competing investments is preferred?
- What is the impact on corporate cash flow if an operating division is spun off?

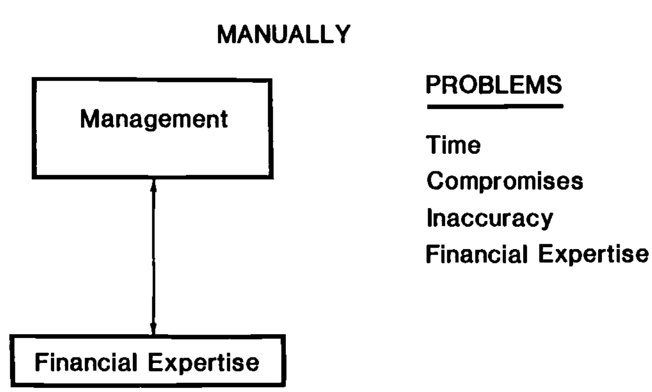
These questions require quick, accurate, and responsive information in order to make an appropriate decision. Modeling can provide that information on a timely basis in order to reduce the risk of making an inappropriate decision.

A HISTORICAL PERSPECTIVE

Modeling is not a new phenomenon. However, there have been some significant technological innovations that have made it much more accessible to all managers.

Prior to the early 1970s, all modeling was done manually, as depicted in Figure 2. Whenever a

Figure 2



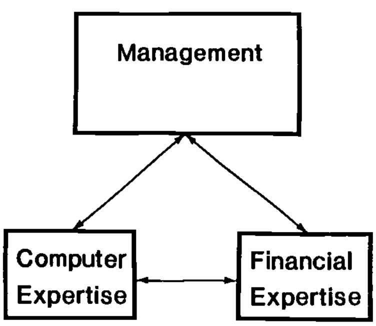
budget, cash flow projection, or investment analysis was prepared, it was "modeled" by a financial manager for top level management. The financial manager, after developing assumptions and certain mathematical relationships, manually (with the help of a calculator) computed the results. Much modeling is still done in this manner.

The manual approach has several drawbacks. First, it is very time consuming. Second, due to the slow processing time, financial managers compromise the model. Instead of using longer, sophisticated mathematical formulations that more closely resemble the real world, they use simpler formulations to save time generating results. Compromising leads to inaccuracy since the model no longer corresponds to real world relationship. Third, errors occur because of the sheer number of computations required. The last problem with this approach arises in the interface between the financial manager and top management. Oftentimes, because of differences in backgrounds and skill mixes, communications breakdown between top management and the financial officer. Management may not receive the information it originally thought it asked for. In addition, top management has no opportunity to ask "what if" questions since doing so would require the financial manager to start all over.

The 197Os brought an automated approach to modeling, the Language-Oriented Planning System (see Figure 3). These systems are "Super-Languages." Examples include GE, Empire, IFPS, and CUFFS. These modeling languages typically require a mainframe computer and can be accessed through time-share or an in-house system.

Figure 3

LANGUAGE ORIENTED PLANNING SYSTEM



PROBLEMS

Development Time

$!

Inflexible

Interface/ Communications

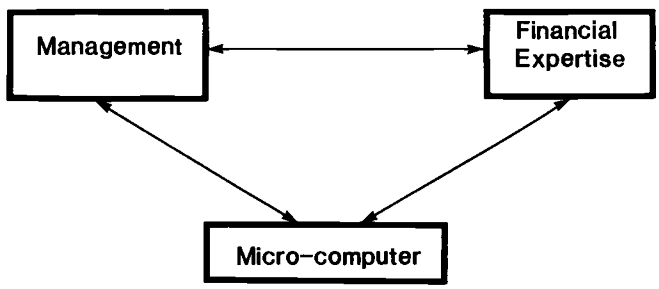
The Language-Oriented planning System approach to modeling was a big improvement to the manual approach since it could provide "what if" analyses on a reasonably timely basis. However, significant disadvantages exist that have limited its availability and usefulness. The first disadvantage is cost. Hardware costs range from $50,000 to $200,000 and up. The software itself costs from $20,000 to $75,000 and up. Then after the software is acquired, the firm must still develop its particular modeling application. This development often requires personnel with computer expertise. The development process is time consuming, often requiring three to six months and more, depending on the complexity of the model.

To develop a workable model, management must interface with data processing personnel in addition to financial personnel. Communication breakdowns frequently occur, causing significant delays and expense. Usually, the information is received too late to be of any value to management.

Management can overcome many of the obstacles of prior modeling tools because of the advent of microcomputers and electronic spreadsheet software (see Figure 4). The advantages of this new modeling tool are discussed below:

Figure 4

MICRO-COMPUTER TECHNOLOGY



- Hardware can be acquired for well under $5,000. Electronic spreadsheet software, such as VisiCalc, Lotus 1-2-3, or Multi-plan, can be acquired for under $500.
- Electronic spreadsheets provide flexibility, speed, and power. Electronic spreadsheets essentially provide free-form work areas on which to format a model in any way desired. They work equally well for strategic planning models as they do for capital investment models. Electronic spread sheets can compute complex mathematical formulations. In fact, almost any real-world situation that can be logically thought out by management can be translated onto an electronic spreadsheet.
- Developing models on an electronic spreadsheet does not require any programming skills. In addition, it is relatively easy to learn how to use an electronic spreadsheet. Basic spreadsheet skills can be mastered in just a few days. This ease-of-use eliminates much

of the communications and interface problems inherent in the other two modeling methods.

- Models can be user friendly. With proper design, models can be constructed in a very understandable and easy-to-read format. In addition, some of the second-generation electronic spreadsheet software such as Lotus 1-2-3, SuperCalc[3], and VisiCalc IV, provide features to develop menu-driven models and perform laborious tasks such as overhead allocation and consolidation of multiple departments.
- Important information can be developed rapidly and accurately. Management can often see and use a working model in anywhere from a few hours to a few weeks depending on the complexity of the model. "What if" analysis is almost instantaneous and modifications are relatively easy to make.

HOW TO DEVELOP USEFUL MODELS

As was discussed above, microcomputers have made modeling available to almost everyone at an affordable price. Unfortunately, this availability does not assure that a firm's modeling efforts will provide the information desired by management.

Figure 5

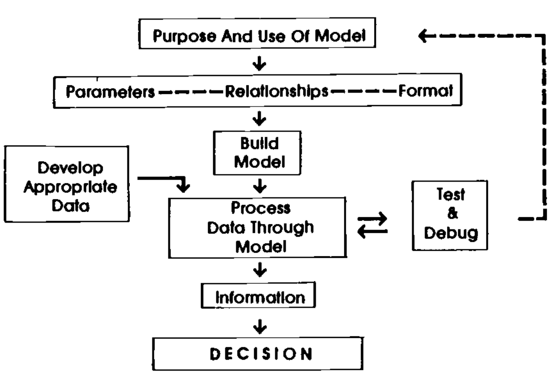


Figure 5 outlines a methodology for model development that has been developed over the past several years. The first task most beginning model builders start with is Building the Model. They sit down at their microcomputer, turn it on, and begin typing. Usually by the time they are done, they have developed a model which is hard to understand, is internally inconsistent, and is impossible for anyone but the model builder to use. Based on past experience, I recommend that the model builder do just the opposite—turn off the computer. In fact, a person should spend as much time or more performing the other tasks in the outline as they do building the model.

Each of the tasks shown in the outline will be discussed briefly below.

PURPOSE AND USE OF THE MODEL

The first and most important task is to clearly define the purpose and use of the model. What decisions will be made as a result of information provided by the model? How frequently will the model be used, and by whom? What factors are of particular concern to management? What level of detail is required? Without careful attention to this task, the model will not be a usable tool in the end. An example of a clearly defined purpose and use might be:

"The purpose of the proposed model is to assess the trade-offs between repairing and replacing a variety of equipment used in milling operations. The key evaluation criteria should be the net present value of the decision to replace. Of particular importance to management is productivity improvements generated by the new equipment."

DEVELOP PARAMETERS, RELATIONSHIPS, AND FORMATS

Based on the purpose and use described above, management defines in detail the parameters (assumptions) and relationships between parameters that are needed to provide the desired information. In addition, the output format is developed and reviewed by management to assure that it is understandable and meets the information requirements.

Parameters

- Output capacity of existing and proposed milling equipment (e.g., MBF, MSF ⅜).
- Variable cost per unit of output including maintenance, energy, labor, etc. for existing and proposed equipment.
- Time frames for analysis, existing and proposed.
- Marginal tax rate, ACRS tax rates, ITC rates.
- Salvage values.
- Interest rates.
- Contractual arrangements including financing covenants and term.
- Inflation rates.

Relationships

- Projected output required.
- Projected capacity utilization.

Formats

The model should show the cash flows associated with both repairing and replacing the milling equipment, highlight the incremental cash flows, and compute net present value. The model should be able to accommodate up to a 10-year timeframe.

The parameters, relationships, and formats should be handwritten prior to building the model. A brief listing of other model building tips is included in Appendix B.

BUILD THE MODEL

The model can now be typed into the computer. Because the model has already been designed, the process is relatively fast.

DEVELOP APPROPRIATE DATA

The input parameters and relationships are developed based on historical trends, discussions with vendors, etc. The quality of the homework performed at this level will have a direct impact on the quality of the model results.

PROCESS DATA THROUGH THE MODEL

At this point, preliminary data can be entered into the model and the assumptions and output can be printed.

TEST AND DEBUG THE MODEL

It is highly important to test and debug the model. Computer generated printouts do not guarantee accuracy. The model should be tested for:

1. Reasonableness—Are the results reasonable? Do they make intuitive sense?
2. Mathematical accuracy and logic—The results of the model should be recalculated by hand under several varying input assumptions to assure their accuracy.
3. Meeting the desired objective—Does the model meet the purpose and use that was originally established?

INFORMATION

The model is now a usable tool. Management can perform unlimited sensitivity analysis to assess the impact of different parameters on the decision. Using the example above, management could ask the following questions:

1. What if materials costs fluctuate significantly?
2. What if energy costs skyrocket?
3. What if inflation picks up again?
4. Should we elect 5% or 10% investment tax credit?
5. What if the estimated reduced falldown is not fully achieved?

DECISION

Based on the What-if analysis provided above, management is in an informed position to make the appropriate decision.

CASE EXAMPLE

A Repair/Replace equipment decision model has been developed as an example of the use of modeling in decision-making by forest product managers. The model can assist management in evaluating the trade-offs between repairing and replacing a variety of equipment used in milling operations. The key evaluation criteria is the net present value of the differential cash flows resulting from the decision to replace. The model highlights the impacts of productivity improvements and reduced falldown.

Two example model printouts are shown in Appendix A, a Planer and a Bar Moulder. There are two pages of printout in each case. The first page contains the assumptions used in each scenario. The second page contains the results.

ASSUMPTIONS

The assumptions are categorized into four broad groups:

1. Capital assumptions, including:
   - The firm's cost of capital
   - Salvage value of the existing equipment
   - Proposed equipment's purchase price
   - Investment tax credit rate (either 8% or 10%)
   - The equipments' output capacity
2. Global operating assumptions, including:
   - The projected inflation rate
   - The firm's marginal tax rate
3. Existing equipment operating assumptions
4. Proposed equipment operating assumptions

Both the existing and proposed equipment operating assumptions are categorized by:

1. Energy costs
2. Materials costs
3. Wage costs
4. Claims expense
5. Maintenance expense

All of the escalators have been tied to the global inflation rate. This linking of rates greatly simplifies the process of changing specific costs over time when these costs are directly related to the expected inflation rate. Rather than changing eight separate assumptions, only one change is required. It is also possible to escalate some costs faster than others. For example, one might expect energy costs to increase faster than the general rate of inflation. In addition, the maintenance costs on the existing equipment might increase faster than the general inflation rate due to increased breakdowns as the machine ages.

The materials cost assumptions for the proposed equipment has been stated as a percentage of SAVINGS over the existing equipment cost. This assumption facilitates the estimate of reduced falldown.

RESULTS

The RESULTS section of each scenario highlights the cash outflows for both the existing and proposed equipment on an after-tax basis. It is assumed that the existing equipment is fully depreciated for tax purposes and the proposed equipment is depreciated over five years using the current ACRS rates. The difference in cash flows between the existing and proposed equipment is then computed. Finally, the net present value using the firm's cost of capital is determined.

In addition, a sensitivity analysis schedule is produced which indicates the net present value under various materials cost and cost of capital assumptions. This analysis quickly highlights for management the crossover points on a project without producing 15 different model runs.

THE TWO EXAMPLES

Example 1, a planer, costs approximately $90,000 and has projected savings primarily in claims with secondary savings in materials, wages, and maintenance. Given the assumptions, the decision to replace has a positive net present value. Therefore, management should approve the capital expenditure.

The sensitivity analysis provides additional information. At certain materials costs and cost of capital assumptions, the net present value is negative. If management expects that there is a high likelihood of a drop in materials costs and the firm's cost of capital rises due to increases in borrowing costs, the decision to replace becomes questionable.

Example 2, a bar moulder, costs significantly more. However, the projected materials costs savings are 25 percent. In addition, significant manpower and maintenance savings are anticipated. The net present value is positive under all assumptions in the sensitivity analysis indicating that the internal rate of return on the investment is well over 15 percent.

OPERATING ENVIRONMENT

The model was developed using Lotus 1-2-3. It took approximately four hours to develop. Each run takes approximately thirty seconds to recompute and another two minutes to print. The sensitivity analysis component is a special feature of 1-2-3.

CONCLUSION

The cost effective decision-making support that these modeling tools can provide has been proven over the past few years. At the same time, the need for improved information by the forest products managers on a timely basis has grown dramatically. It appears that every forest products concern, small and large, could enhance the quality of the decision-making process through the implementation of modeling activities.

APPENDIX A

Case Example Results

Examples 1 and 2 are shown on the following pages. Each example has one page for assumptions and one page for results.

EXAMPLE 1

Key Assumptions:

- Purchase a replacement planer for $90,000
- Significant reduction in claims expense
- Additional savings in reduced falldown, productivity, and maintenance

Results:

- Positive net present value under certain cost of capital and materials cost scenarios

EXAMPLE 2

Key Assumptions:

- Purchase a replacement bar moulder for $130,000
- Substantial reduction in falldown
- Additional savings in energy, productivity, claims, and maintenance

Results

- Positive net present value under all cost of capital and materials cost assumptions

APPENDIX B—MODEL BUILDING TIPS

1. Preplan—develop a handwritten format.
2. Don't mix inputs and outputs. Do not imbed parameters and relationships within the report section of the model. In addition, have all the assumptions in one area, not dispersed throughout the model.
3. Make the model self documenting:
   - Generously use run names and dates.
   - Use adequate verbal descriptions—don't abbreviate.
   - For complex computations, develop subsidiary schedules.
4. Know your printer width before designing reports.

Run Name-->Planer 30-Mar-84

Studies in Management and Accounting for the Forest Products Industry

Case Example 1 - REPAIR/REPLACE Decision
by Steve Reiff

ASSUMPTIONS

Capital Assumptions

The Firm's Cost of Capital	12.50%
Salvage Value of Existing Equipment (net of Tax Effects).	0
Purchase Price of Proposed Replacement . . .	90,000
Investment Tax Credit Rate	8.00%
Units of output capacity (it is assumed that both the existing and proposed equipment have the same capacity and that both will be operated at capacity)	50,000

Operating Assumptions	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Overall Inflation Rate	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Marginal Tax Rate	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%
Existing Equipment Operating Characteristics:										
Energy costs per unit (enter 1st year only)	$0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04
Escalator (+/- overall inflation rate)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Materials costs per unit(enter 1st yr only)	$0.45	0.48	0.51	0.54	0.57	0.60	0.64	0.68	0.72	0.78
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.00%
Wage Assumptions:										
Units produced/manhour	75	75	75	75	75	75	75	75	75	75
Average hourly rate (enter 1st yr only)	$16.50	17.49	18.54	19.65	20.83	22.08	23.41	24.81	26.30	27.88
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Claims Expense (in dollars)	$7,000	7,420	7,865	8,337	8,837	9,368	9,930	10,525	11,157	11,826
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Annual Maintenance Costs	$4,000	4,325	4,676	5,056	5,466	5,910	6,390	6,909	7,470	8,076
Escalator (+/- overall inflation rate)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Proposed Replacement Operating Characteristics:										
Energy costs per unit (enter 1st year only)	$0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04
Escalator (+/- overall inflation rate)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Materials cost SAVINGS as a % of Existing costs(enter 1st yr only)	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
Wage Assumptions:										
Units produced/manhour	95	95	95	95	95	95	95	95	95	95
Average hourly rate	$16.50	17.49	18.54	19.65	20.83	22.08	23.41	24.81	26.30	27.88
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Claims Expense (in dollars)	$0	0	0	0	0	0	0	0	0	0
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Annual Maintenance Costs	$2,000	2,099	2,202	2,311	2,450	2,597	2,753	2,918	3,093	3,279
Escalator (+/- overall inflation rate)		-1.00%	-1.00%	-1.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

5. Keep the parameters and relationships in terms understandable to management. Minimize the number of inputs required. (This may require complex processes to achieve meaningful output.)
6. Use directories and menus for larger models.
7. Use keystroke savings features (macros) whenever possible (available on Lotus 1-2-3, Advanced Version VisiCalc, SuperCalc³, and others).
8. Backup files frequently.
9. Correct all related cell references when making modifications.
10. Don't run untested models. Perform reasonableness tests.

Run Name-->Planer
Run Date--> 30-Mar-84

Case Example - REPAIR/REPLACE Decision
RESULTS

Existing Equipment Cash Flow Analysis	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Energy Costs	1,000	1,081	1,169	1,264	1,367	1,478	1,597	1,727	1,867	2,019
Materials Costs	22,500	23,850	25,281	26,798	28,406	30,110	31,917	33,832	35,862	38,774
Wage Costs	11,000	11,660	12,360	13,101	13,887	14,720	15,604	16,540	17,532	18,584
Claims Expense	7,000	7,420	7,865	8,337	8,837	9,368	9,930	10,525	11,157	11,826
Maintenance Expense	4,000	4,325	4,676	5,056	5,466	5,910	6,390	6,909	7,470	8,076
Depreciation	0	0	0	0	0	0	0	0	0	0
Deductible Expense	45,500	48,336	51,351	54,556	57,963	61,586	65,437	69,533	73,888	79,280
Income Tax Effect	(20,930)	(22,235)	(23,621)	(25,096)	(26,663)	(28,329)	(30,101)	(31,985)	(33,989)	(36,469)
Net After Tax Operating Expense	24,570	26,101	27,729	29,460	31,300	33,256	35,336	37,548	39,900	42,811
Add Depreciation	0	0	0	0	0	0	0	0	0	0
Net After Tax Cash Outflow	24,570	26,101	27,729	29,460	31,300	33,256	35,336	37,548	39,900	42,811

Proposed Replacement Equipment Cash Flow Analysis	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Energy Costs	1,000	1,081	1,169	1,264	1,367	1,478	1,597	1,727	1,867	2,019
Materials Costs	20,925	22,181	23,511	24,922	26,417	28,002	29,683	31,463	33,351	36,059
Wage Costs	8,684	9,205	9,758	10,343	10,964	11,621	12,319	13,058	13,841	14,672
Claims Expense	0	0	0	0	0	0	0	0	0	0
Maintenance Expense	2,000	2,099	2,202	2,311	2,450	2,597	2,753	2,918	3,093	3,279
Depreciation	13,500	19,800	18,900	18,900	18,900	0	0	0	0	0
Deductible Expense	46,109	54,366	55,540	57,740	60,097	43,698	46,351	49,166	52,153	56,029
Income Tax Effect	(21,210)	(25,008)	(25,549)	(26,561)	(27,645)	(20,101)	(21,322)	(22,617)	(23,990)	(25,773)
Net After Tax Operating Expense	24,899	29,358	29,992	31,180	32,453	23,597	25,030	26,550	28,163	30,256
Adjustments:										
Depreciation	(13,500)	(19,800)	(18,900)	(18,900)	(18,900)	0	0	0	0	0
Investment Tax Credit	(7,200)	0	0	0	0	0	0	0	0	0
Salvage Value on Existing Equipment	(0)	0	0	0	0	0	0	0	0	0
Purchase Price	90,000	0	0	0	0	0	0	0	0	0
	69,300	(19,800)	(18,900)	(18,900)	(18,900)	0	0	0	0	0
Net After Tax Cash Flow	94,199	9,558	11,092	12,280	13,553	23,597	25,030	26,550	28,163	30,256

Difference between Existing and Proposed Equipment	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Net After Tax Cash Flow	(69,629)	16,544	16,638	17,180	17,747	9,659	10,306	10,998	11,737	12,555

NET PRESENT VALUE-------------> 4,941

NET PRESENT VALUE SENSITIVITY ANALYSIS

		Cost of Capital		
	##########	10.00%	12.50%	15.00%
	$0.35	9,853	3,635	(1,538)
	0.40	10,585	4,288	(952)
Material	0.45	11,318	4,941	(366)
Costs --->	0.50	12,050	5,594	220
	0.55	12,783	6,247	806

Run Name-->Bar Moulder 30-Mar-84

Studies in Management and Accounting for the Forest Products Industry

Case Example 2 - REPAIR/REPLACE Decision
by Steve Reiff

ASSUMPTIONS

Capital Assumptions

The Firm's Cost of Capital	12.50%
Salvage Value of Existing Equipment (net of Tax Effects).	10,000
Purchase Price of Proposed Replacement . . .	130,000
Investment Tax Credit Rate	10.00%
Units of output capacity (it is assumed that both the existing and proposed equipment have the same capacity and that both will be operated at capacity)	520,000

Operating Assumptions	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Overall Inflation Rate	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Marginal Tax Rate	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%	46.00%
Existing Equipment Operating Characteristics:										
Energy costs per unit (enter 1st year only)	$0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06
Escalator (+/- overall inflation rate)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Materials costs per unit(enter 1st yr only)	$0.70	0.74	0.79	0.83	0.88	0.94	0.99	1.05	1.12	1.21
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.00%
Wage Assumptions:										
Units produced/manhour	40	40	40	40	40	40	40	40	40	40
Average hourly rate (enter 1st yr only)	$15.00	15.90	16.85	17.87	18.94	20.07	21.28	22.55	23.91	25.34
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Claims Expense (in dollars)	$5,000	5,300	5,618	5,955	6,312	6,691	7,093	7,518	7,969	8,447
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Annual Maintenance Costs	$10,000	10,812	11,690	12,639	13,665	14,775	15,975	17,272	18,674	20,191
Escalator (+/- overall inflation rate)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Proposed Replacement Operating Characteristics:										
Energy costs per unit (enter 1st year only)	$0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04
Escalator (+/- overall inflation rate)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Materials cost SAVINGS as a % of Existing costs(enter 1st yr only)	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Wage Assumptions:										
Units produced/manhour	50	50	50	50	50	50	50	50	50	50
Average hourly rate	$15.00	15.90	16.85	17.87	18.94	20.07	21.28	22.55	23.91	25.34
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Claims Expense (in dollars)	$0	0	0	0	0	0	0	0	0	0
Escalator (+/- overall inflation rate)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Annual Maintenance Costs	$6,000	6,296	6,607	6,934	7,350	7,791	8,258	8,754	9,279	9,836
Escalator (+/- overall inflation rate)		-1.00%	-1.00%	-1.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Fun Name-->Bar Moulder
Run Date--> 30-Mar-84

Case Example - REPAIR/REPLACE Decision
RESULTS

Existing Equipment Cash Flow Analysis	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Energy Costs	15,600	16,867	18,236	19,717	21,318	23,049	24,921	26,944	29,132	31,498
Materials Costs	364,000	385,840	408,990	433,530	459,542	487,114	516,341	547,321	580,161	627,270
Wage Costs	195,000	206,700	219,102	232,248	246,183	260,954	276,611	293,208	310,800	329,448
Claims Expense	5,000	5,300	5,618	5,955	6,312	6,691	7,093	7,518	7,969	8,447
Maintenance Expense	10,000	10,812	11,690	12,639	13,665	14,775	15,975	17,272	18,674	20,191
Depreciation	0	0	0	0	0	0	0	0	0	0
Deductible Expense	589,600	625,519	663,637	704,089	747,021	792,583	840,940	892,264	946,737	1,016,854
Income Tax Effect	(271,216)	(287,739)	(305,273)	(323,881)	(343,629)	(364,588)	(386,833)	(410,441)	(435,499)	(467,753)
Net After Tax Operating Expense	318,384	337,780	358,364	380,208	403,391	427,995	454,108	481,822	511,238	549,101
Add Depreciation	0	0	0	0	0	0	0	0	0	0
Net After Tax Cash Outflow	318,384	337,780	358,364	380,208	403,391	427,995	454,108	481,822	511,238	549,101

Proposed Replacement Equipment Cash Flow Analysis	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Energy Costs	10,400	11,244	12,158	13,145	14,212	15,366	16,614	17,963	19,421	20,998
Materials Costs	273,000	289,380	306,743	325,147	344,656	365,336	387,256	410,491	435,121	470,452
Wage Costs	156,000	165,360	175,282	185,798	196,946	208,763	221,289	234,566	248,640	263,559
Claims Expense	0	0	0	0	0	0	0	0	0	0
Maintenance Expense	6,000	6,296	6,607	6,934	7,350	7,791	8,258	8,754	9,279	9,836
Depreciation	18,525	27,170	25,935	25,935	25,935	0	0	0	0	0
Deductible Expense	463,925	499,451	526,724	556,959	589,100	597,256	633,417	671,774	712,461	764,845
Income Tax Effect	(213,406)	(229,747)	(242,293)	(256,201)	(270,986)	(274,738)	(291,372)	(309,016)	(327,732)	(351,829)
Net After Tax Operating Expense	250,520	269,703	284,431	300,758	318,114	322,518	342,045	362,758	384,729	413,016
Adjustments:										
Depreciation	(18,525)	(27,170)	(25,935)	(25,935)	(25,935)	0	0	0	0	0
Investment Tax Credit	(13,000)	0	0	0	0	0	0	0	0	0
Salvage Value on Existing Equipment	(10,000)	0	0	0	0	0	0	0	0	0
Purchase Price	130,000	0	0	0	0	0	0	0	0	0
	88,475	(27,170)	(25,935)	(25,935)	(25,935)	0	0	0	0	0
Net After Tax Cash Flow	338,995	242,533	258,496	274,823	292,179	322,518	342,045	362,758	384,729	413,016

Difference between Existing and Proposed Equipment	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Net After Tax Cash Flow	(20,611)	95,247	99,868	105,385	111,212	105,477	112,063	119,064	126,509	136,085

NET PRESENT VALUE------------> 487,886

NET PRESENT VALUE SENSITIVITY ANALYSIS

	###########	Cost of Capital 10.00%	12.50%	15.00%
	$0.60	500,335	439,373	388,030
	0.65	527,544	463,629	409,795
Material	0.70	554,753	487,886	431,560
Costs --->	0.75	581,962	512,142	453,325
	0.80	609,171	536,398	475,091

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 and January 1981.)

"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 1976.

"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.

"Pool Log Transfer System," issued August 1979.

"Fundamentals of Financing Major Timber Acquisitions," issued February 14, 1980.

"LIFO Inventories in the Forest Products Industry," issued July 1980.

"Accounting Controls for a Forest Products Firms," issued January 1981.

"Log Inventory Controls," issued April 1981.

"Accounting Treatment for Wood Products Futures Trading Activities," issued October 1981.

"A Reporting and Planning System for a Wood Products Operations," issued November 1981.

"Boise Cascade's Productivity Improvement Program," issued January 1982.

"Information Systems Planning in Weyerhaeuser Company," issued August 1982.

"Developing a Strategic Plan for a Forest Products Company: A Case Study," issued March 1983.

"Company/Employee Gainsharing Programs," issued July 1983.

"Productivity Improvement Programs of Knowledge Workers in the Forest Products Industry," issued November 1983.

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