ANALYZING INVESTMENTS IN THIN-KERF SAWS

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INTRODUCTION

The rising cost of hardwood sawlogs has increased sawmill managers' interest in considering the installation of thin-kerf sawing machines in their sawmills. Replacement of circular headrigs by band headrigs and/or reducing resaw kerfs[1] are the available options. Equipment replacement or modification to achieve thin-kerf sawing will require an investment. Sawmill managers making such an investment will desire to reduce risk by determining the probable investment outcome. Determining the probable outcome with some certainty can require a complex analysis. The staffs of many sawmill firms don't possess all the required information to perform such a complex analysis. One option for them is to turn to a consultant with the required skills. However, a preliminary analysis to determine the relative potential for the investment will help sawmill managers determine whether employing a consultant would be worthwhile.

ECHO (Economic Choice for Hardwood Operations) is computer software that incorporates the skills of a trained investment analyst to assist sawmill managers in developing a detailed analysis of the investment results from expenditures for thin-kerf sawing equipment and services. Although the ECHO software is detailed and accurate, it is not intended to be the final estimate of financial feasibility. Obtaining professional investment advice is necessary to prevent errors of judgement in performing the analysis.

This paper describes how to perform an analysis of an investment in thin-kerf sawing by describing the steps performed by ECHO to determine payback period, rate of return, and present net worth. A hypothetical installation of a band headrig to replace a circular headrig is used as an example. The logic behind the ECHO steps to perform the analysis is explained using the information for the example sawmill investment. The explanation of this logic should assist those who desire to perform such an analysis to do so even without the ECHO software.

ESTIMATING INVESTMENT COSTS

Investment analysis reduces risk by accurately estimating the costs and benefits that will result from a proposed investment. Investment costs can be determined by contacting vendors of the equipment and services required. While software is of no assistance in developing accurate cost estimates, the ECHO software does prompt the user for most cost items that may be incurred when investing in thin-kerf sawing. This may help to reduce the risk of overlooking costs involved in the investment.

The following hypothetical situation supposes that the management of an example sawmill desires to replace its circular headrig with a new band headrig. Note that ECHO is also able to analyze installation of a thin-kerf resaw in addition to, or instead of, analyzing investments in a band headrig.

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[1]The term kerf refers to both the sawtooth width as well as the actual sawline made in sawing.

Mr. Conrad Rehagen, President of Rustic Wood Products, Perryville, Missouri, has provided the specific investment costs that he encountered when he converted from a circular to band headrig in 1991[2] as follows:

INVESTMENT COSTS

	Actual 1991	Inflated (15 %)
Band headrig (6')	$80,000	$92,000
Filing room equipment	27,000	31,050
Filing room	15,000	17,250
Installation costs	10,000	12,650
Sawblades, initial cost	———	4,000
Sawbrake	5,000	5,750
Debarker	0	0
Total	$137,000	$162,700

The authors have applied a 15 percent inflation factor to the original costs experienced by Rustic Wood Products to bring them closer to current costs. However, these investment values should not be used for an actual investment analysis; instead more current values should be obtained for your specific situation from the vendors that you intend to employ. The initial sawblade cost was not included as an investment cost by Mr. Rehagen but was added by the authors as an initial expense that they considered necessary.

The ECHO software will prompt users for investment costs in the above categories plus some others. This includes the debarker investment that Rustic Wood Products did not require because a debarker was currently in place. Other investments, however, may be required for which ECHO does not explicitly prompt. For example, a sawpit is frequently required when a band headrig is installed in the location formerly occupied by a circular headrig in a sawmill that does not have equipment installed on a raised foundation. The expense for this sawpit must be included as an investment expense in the analysis. For this purpose the software asks the user for any general investment costs that may be incurred in addition to those specifically prompted. Any investment expenses for which there is no prompt must be entered in the category of additional investment expenses.

Mr. Rehagen estimated that Rustic Wood Products sawmill annual costs increased as a result of the band headrig installation as follows:

ESTIMATED ANNUAL COSTS

	Actual 1991	Inflated (15%)
Headrig maintenance	$1,000	$1,150
Saw replacement	2,000	2,300
Grinding wheels and guides	1,000	1,150
Annual wheel resurfacing	500	575
Filer salary	38,000	43,700
Total	$42,500	$48,875

[2] Presentation titled "Case History of a Band Headrig Conversion," by Mr. Conrad Rehagen, President of Rustic Wood Products, given at the Thin-Kerf Saw Technology in Hardwoods Seminar, Midwest Section Meeting of the Forest Products Society. St. Louis, MO. April 23, 1992.

ECHO prompts the user to enter values for each of these variable costs. However, as with investment costs, variable costs may be incurred for which there is no specific prompt. For these costs, the user is prompted by ECHO to enter the total value of all variable costs for which there was no prompt. For our example, we will assume that all costs were accounted for by the specific prompts provided by ECHO and a zero will be entered at the additional variable cost prompt.

The increased conversion efficiency that will result from the reduction in kerf from the current investment is estimated by ECHO based on the difference in the current and new kerf. The kerf width of our sawmill's circular headrig is currently 0.280 inch. Some hardwood sawmills are currently able to saw with 0.140-inch band headrig kerfs. However, our sawmill management wishes to be conservative and chooses to begin sawing on the band headrig with a kerf width of 0.180 inch. Therefore, the sawmill will realize a wood fiber saving due to kerf reduction of 0.100 inch for each sawline made by the headrig.

The ECHO software also requires information on each sawmill's current average log diameter and length because potential conversion efficiency improvement percentages are related to the average log size processed. For this sawmill our average log diameter is estimated to be 15 inches and average log length is estimated to be 12 feet.

When new machines with reduced kerf are installed, sawing variation will often also be reduced. The one-standard-deviation value of sawing variation for circular headrigs in one study was determined to be 0.054 inch (2). The same study found a 0.049-inch one-standard-deviation sawing variation value for band headrigs. Considerable improvements in band headrig technology have taken place since this study, however, and a one-standard-deviation sawing variation value of 0.030-inch should be achievable with a new machine. Each sawing machine vendor should be requested to specify the sawing variation value achievable by its machine and this value should be used in the analysis.

The one-standard-deviation sawing variation value must next be converted into the wood fiber savings that can be expected for each sawline made by the machine. This is done following the methodology of Brown (1) by multiplying the one-standard deviation value by 1.645 to obtain a value known as the *sawing allowance.* This sawing allowance value is the amount of wood fiber that must be added to the rough green size of each piece of lumber to insure that planer skip due to sawing variation will be equal to or less than 5 percent. Assuming that the circular headrig in our sawmill saws at the historical one-standard-deviation value of 0.054-inch, the sawing allowance would be 0.089 inch. For our new band headrig, with a standard deviation value of 0.030-inch sawing variation, the sawing allowance is 0.050 inch. The wood fiber saving then that will be obtained for our example sawmill is the difference between these values which is 0.039 inch (0.089 inch -0.050 inch = 0.039 inch). This value must be accounted for as a reduction in the rough green size of the lumber cut by the new band headrig. After computing this number, sawmill management must determine whether they can market their lumber at this reduced rough green size. Some lumber buyers may resist buying lumber sized to a rough green size that reflects the total reduction in sawing allowance. If this is the case the sawmill may not be able to realize the total savings in fiber computed but it will realize some percentage of it.

In our case, however, we're confident that the entire sawing variation reduction of 0.039 inch can be realized once our buyers appreciate the advantages of our new sawing accuracy. We have chosen to assume that our lumber sizes can be reduced from 1.139 inch to 1.100 inch for 4/4 lumber and from 1.420 inch to 1.381 inch for 5/4 lumber.

An additional piece of information required by ECHO is the percentage of total production accounted for by each lumber thickness. Changes in rough green size influence lumber yield differently depending on the actual thickness of each lumber size produced. The same value reduction in rough green size will increase yield more for 4/4 lumber than for 5/4 lumber, for example. For this reason, ECHO prompts the user for the amount of each thickness as a percentage of total volume production that is produced by the sawmill. For this example sawmill, the production of 4/4 and 5/4 lumber are assumed to be equivalent volumes with 50 percent of each produced.

Next, we must realize that installation of a new band headrig will not obtain increased conversion efficiency for that percentage of lumber production processed at a resaw. The ECHO software handles this situation by prompting for the percentages of lumber of each size processed at the headrig versus the resaw. For this example, we will assume that 70 percent of lumber production is at the headrig and 30 percent is at the resaw for both 4/4 and 5/4 lumber thicknesses.

Cants that are not cut into dimension lumber will also not result in conversion efficiency improvement because the improved sawing variation is not a significant consideration in cant sizing. For this reason, the average percentage of log volume processed in cants must also be estimated by the user to allow ECHO to account for this factor. For our example, we will assume that 19 percent of the sawmill production is produced as cants in the form of railroad ties.

Based on the information we've provided, the ECHO program can now compute the estimated percentage improvement in lumber production. For our example, the estimated yield increase is 5.6 percent.

Sawmill management of our example sawmill must now decide whether to obtain this potential increased yield as lumber production or to reduce log purchases such that the same volume of lumber will be produced annually. Some factor, such as limited kiln capacity, for example, may prevent the sawmill from expanding production to the total potential lumber percentage increase. Lumber production could also be increased from the current annual production of 10,000 MBF by some percentage of the total possible yield increase, while log purchases could be reduced to reflect the remainder of the yield increase not required in lumber volume. Sawmill management feels that 60 percent of the potential total percentage of increased lumber yield can be processed with current sawmill equipment and staff. For the other 40 percent, log purchases should be reduced to prevent incurring additional investment and processing costs.

Computation of the savings resulting from reducing log volume purchases requires information on current per-thousand-board-feet (MBF) log costs and the current annual log volume purchased by the sawmill. Log costs for this sawmill are $350 per MBF, and the annual log volume purchased is 9,000 MBF.

Therefore, 60 percent, or 336 MBF of the potential increased lumber production of 560 MBF will actually be produced by the sawmill to bring total annual lumber production to 10,336 MBF. Log purchases will be reduced by enough so that only this 10,336 MBF is produced and no more. Our improved conversion efficiency has increased our overrun from 11.1 percent (10,000 MBF lumber ÷ 9,000 MBF logs -1 x 100) to 17.3 percent (10,336 MBF lumber ÷ 9,000 MBF logs -1 x 100). With our new overrun of 17.3 percent we compute the volume of logs required to produce the necessary 10,336 MBF (10,336 MBF lumber ÷ 1.173 = 8,811.6 MBF logs) to be 8,811.6 MBF. Therefore, we can sell 10,336 MBF of lumber, but we will need to purchase 188.4 MBF less log volume than the 9,000 MBF that we currently purchase. If our delivered log costs are $350/MBF, we will realize an annual cost reduction of $65,940 as a result of purchasing reduced log volume.

As previously discussed, there will be 336 MBF of additional lumber we will sell as a result of accepting 60 percent of the 5.6 percent lumber volume increase as lumber sales. We can sell this amount of lumber without purchasing any additional logs at all. In fact, we have shown that we will purchase a reduced volume of logs and already know the positive financial benefit of this savings. Although we do not have to buy logs, we can assume that we will receive the same sales price that we currently do for the lumber. This means that we will save $350/MBF on our delivered log costs for each additional MBF of lumber sold. Therefore, we will realize increased revenue of $117,600 ($350/MBF x 336 MBF) from sales of the 336 MBF of additional lumber we will sell. We will also receive our current profit which is $50/MBF to give us an additional $16,800 ($50/MBF x 336 MBF) revenue benefit. The total positive revenue benefits are therefore, as follows:

INCREASED REVENUE FROM INVESTMENT

$65,940	from reduced log purchases
117,600	from increased revenue due to zero log costs
16,800	from increased profit
$200,340	total positive revenue increase.

Something to consider is that management may want to reduce its lumber sales price to become more competitive as a result of the installation of the band headrig. A reduced sales price value can be entered into the ECHO analysis. We assume that sawmill management desires to reduce the per-MBF sales price by $10 to pass on some of its new efficiency to their customers. This reduces annual revenues by $103,360 ($10 x 10,336 MBF) and results in a new total positive-revenue-increase value of $96,980 ($200,340 -$103,360 = $96,980).

Summarizing our analysis to this point, with the installation of a new band headrig, sawmill management can reduce wood fiber per sawline by a total of 0.139 inch. This was achieved by reducing kerf by 0.100 inch and sawing variation by 0.039 inch. The total investment cost will be $162,700, with recurring annual costs of $48,845. The increased potential conversion efficiency of 5.6 percent will be allocated 60 percent to increased lumber production and 40 percent to reduced log purchases. A reduced sales price of $10 per MBF will be passed on to sawmill customers to improve the sawmill's competitive position. Total increased revenue from these changes is estimated to be $96,980 per year.

ECHO now has nearly all of the information required to perform a 10-year discounted cash flow analysis to provide the investment feasibility measures of payback period, after-tax rate-of-return, and present net worth. Additional information required to compute these measures of investment feasibility are the discount rate, income tax rate, and insurance and property tax rates. The discount rate is usually considered to be that rate of return that the sawmill could obtain from placing capital in the best available alternative investment. The discount rate can also be understood to be that rate of return that the sawmill requires in order to make the investment. The discount rate for the after-tax analysis performed by ECHO should account for inflation. For our example, sawmill management determines that 12 percent is the best alternative investment available for its funds and chooses this as the discount rate. The tax rate for the sawmill is 25 percent, and the insurance and property tax rates are each 1 percent of assets.

With the described inputs ECHO performs a discounted cash flow analysis. All measures of feasibility are after-tax values with depreciation considered by the straight-line method. The payback period from the investment in the band headrig is estimated to be 4.0 years. The after-tax rate of return is 21.7 percent. Present net worth is $89,281.

The measure-of-feasibility values resulting from this analysis indicate that the proposed investment is very attractive. However, sawmill management should not choose to make such an investment based on a single ECHO analysis. It is very important to perform a sensitivity analysis to determine those cost and benefit values that may have a large impact on the outcome of the investment. For example, sawmill managers that have experienced many market downturns and lower lumber sales prices will want to perform a worst-case analysis of such a situation. When lumber markets are poor, both log costs and lumber prices decrease, but their relationship to one another may change such that the investment outcome will differ. The results of these changed relationships can be explored by making additional ECHO runs based on historical information on log and lumber costs in down markets. It is also a mistake to base the investment feasibility only on log and lumber prices experienced during poor market conditions as these prices will rarely last for the length of time the investment is being paid off. Additional analysis using average prices expected over the term of the investment should be performed.

Other cost and benefit values that are subject to change during the investment period should also be tested to determine their potential influence on the investment outcome should such change actually occur.

ECHO is a tool designed to perform a preliminary analysis to estimate the potential of an investment in thin-kerf sawing. However, the opinion of an experienced investment analyst should be obtained prior to undertaking an actual investment.

The ECHO software is currently undergoing testing. At the conclusion of these tests the software will be available at no cost. Information on ordering ECHO is available from the senior author:

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Please provide information on diskette size and type desired.

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