PIASC

Capital Budgeting...
The Machinery Acquisition Decision

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The Machinery Acquisition Decision

Most of us are all too familiar with the informality of the decision to purchase a piece of equipment. Many times we have expended thousands of dollars with only a "gut" feeling that the decision would improve the economic health of our firm. Of course, the purchase decision requires a prediction of future events and predictions are necessarily chancy things; but this brief paper will illustrate a method that will reduce the uncertainty to a minimum, make possible the explicit recognition of the quantitative effect of this uncertainty, and finally integrate all of the relevant elements into a logical and economically sound whole which will provide an unequivocal indication as to the proper decision. All this from a method which is really easy to apply!

First, what are we trying to accomplish?

It has been suggested that the fundamental axiom of business is "buy low-sell high"; it is certainly reasonable to state that business activities (the sale of a product of service) should return more than their cost if the firm is to stay solvent. If we were running a grocery store it would be apparent that if cans of peas are sold to us by the wholesaler for 12 cents, we must be able to sell them for more than 12 cents and failing to do so we should discontinue stocking peas. It is just so with a piece of machinery, if the manufacturer is willing to sell it to us for $50,000 we (that is, the owners of the firm, not the paper suppliers, employees, etc.) must be able to receive more than $50,000 or the decision to purchase is unwise.

Second, what information do we need?

Obviously, we need to know what the cost for purchase and installation of the machine will be (a piece of information that our machinery salesman will be happy to reduce to contract form). We need then to know the sources and amounts of the returns to be gained from the use of the machine (again, net of amounts paid for labor and materials). These returns appear to fall under three basic heads.

TAXES. The ownership of a capital asset gives rise to a reduction in taxes through Capital Cost Recovery (Depreciation). This tax reduction is a return on the decision to purchase (if a 44% taxpayer firm records additional depreciation of $1,000 it reduces its taxes by $440).

COST REDUCTION. The possession of a machine may make possible a reduction in production costs now being incurred by the firm in performing its existing work. Care must be taken to include only those cost reductions that are realizable. Improvements of 5% or 10% frequently have no effect because it is impossible to hire employees for 95% or 90% of the day. In general, cost reductions must be sufficient to provide for the elimination of whole employees or recognizable quantities of supplies before they constitute a return to the firm PIA Production Standards can be an invaluable data source in the evaluation of proposed cost reductions as they enable a determination to be made of the production time required to perform the existing work based on new equipment.

ADDITIONAL SALES. The purchase of a machine may make possible an increase in sales by extending capacity or by opening up the door to new products or services. The return to the firm on these sales is the difference between the sales amounts and the out-of-pocket (employees' wages, materials and supplies) costs of performing the work. The amount of uncertainty involved in predictions in this area is very great since prices, volumes and costs must be assumed, thus decisions that are heavily dependent on additional sales deserve careful analysis.

Third, what about the time factor?

One might ask, what time factor? In the beginning, we talked about a grocer and a can of peas. We concluded that if he bought a can for 12 cents and could sell it for, say, 15 cents he would probably wish to carry peas in his stock. But, suppose that he would have to hold that can of peas for five years in order to make the sale, would then choose to carry peas? Probably not. And why, because of the time value of money, the return he could have earned on the investment of 12 cents in something other than peas during the five years and

which he would forego if he chose to buy and stock peas. To put this another way, if you believed that you might earn 10% per year on your funds and someone offered you a choice between receiving $1.00 today and $1.05 a year from now, you would certainly choose $1.00 today. Just as certainly, if you were offered $1.00 today or $1.15 a year from now, you would choose $1.15 a year from now. Of course, you would be indifferent between $1.00 today and $1.10 a year from now.

The process of stating future returns in terms of present dollars is usually called "discounting" and therefore in our example the "discounted present value" of $1.10 to be received one year from now is $1.00 given a return on funds of 10%. In economic terms $1.00 today and $1.10 in one year are equal. The mathematical formula for discounting is as follows:

Present Value = Minus (2nd Year Net Return / (1 + r)2 ...Plus

Where r = rate of return, n = number of years

Pocket calculators with financial functions can easily do this.

Before we leave the discussion of the time factor we ought to take a look at the rate of return to be used in the discounting process. It is customary to call this rate "cost of capital of the firm" but one should remember that the word "cost" here carries its economic definition, that is, it is an "opportunity" cost. The opportunity cost of using an asset (money in this case) is the return that would have been earned by the asset in its best and highest alternative use. If the funds necessary to purchase the can of peas could have been placed in a use that would have earned 14% then their (the fund's) opportunity cost is 14% and the firm's cost of capital is 14%.

In a practical business situation, the best measure of the cost of capital is probably the return on working capital (current assets minus current liabilities divided into net profit). In our industry this would usually be between 12% and 25%; we have used 15% in our example.

It is important to remember that the cost of capital is not the rate that one pays at the bank to borrow funds which should be less than the return on working capital (otherwise, why would one borrow at all?). You will notice that our analysis does not take into account the method of financing (retained earnings, debt, or lease) because the cost of the funds is fully incorporated into the cost of capital and therefore into the discount rate and more importantly because the optimum method for obtaining one's capital supply is a completely independent question from the optimum use of that supply (e.g. purchase of machinery).

Fourth, how does all this come together?

To make this clear, we have worked out an example of a proposed machinery acquisition. The indicated decision is clear: where the discounted present value of the receipts and expenditures (cash flows) associated with the purchase is positive, one should buy as the firm's wealth will increase by this amount; if the sum is negative, one should not buy in order to avoid the indicated reduction in wealth.

The funds flows are summarized by years as a matter of convenience. This naturally has some small effect on the accuracy of the results as the transactions really occur throughout the year. In most situations, this inaccuracy will not affect the results but one could summarize in shorter periods and discount at an appropriate rate (for example, 1.25% a month rather 15% a year).

PROPOSED DECISION
Trade in existing 38" four color press on new 40" six color with coater and console.

BACKGROUND
Finn has sufficient work (four color jobs) to fill present four color press on two shifts.

ANTICIPATED ADVANTAGES
Press will be able to perform all present work in one shift, thus saving two crew members (with respect to existing work). Additional capabilities of new press will make possible the sale of additional work immediately and an additional shift of four to six color work within four years.

PROPOSED CAPITAL EXPENDITURE
$2,500,000 quoted price of new press net of trade-in and including installation.

SCHEDULE 1

CAPITAL COST RECOVERY

Year	Capital Cost Recovery	Tax Reduction
1	$714,250	$314,270
2	510,250	224,510
3	364,500	160,380
4	260,000	114,400
5	217,000	95,480
6	217,000	95,480
7	217,000	95,480
	2,500,000	1,100,000

Notes:

1. MACRS System is used (7 year life, 200% declining balance switching to straight line).

2. Assumes a Marginal tax rate of 44%.

3. Only possible uncertainty here is a change in the tax laws.

SCHEDULE 2

COST REDUCTION

Year	Realized Savings	Savings Net of Tax
1	$108,000	$60,480
2	110,160	61,690
3	112,363	62,923
4	114,610	64,182
5	116,903	65,465
6	119,241	66,775
7	121,626	68,110
8	124,058	69,473
9	126,539	70,862
10	129,070	72,279
	1,182,570	662,239

Notes:
1. Cost reduction on existing work is computed as follows:

Present Crew-
Day Pressmen
Day feeder
Night Pressmen
(38" 2C-Two Shifts)

Proposed Crew-
Day 1st Pressmen
Day 2nd Pressmen
(40" 6C- One Shift)

Net annual reduction in wages is $83,000 and fringes $25,000 for a total of 88,000 in year 1.

2. A 2% annual inflation rate is assumed in wages and fringes after year 1.

3. Savings net of tax is computed by using (1 - t) times Savings where "t" is marginal tax rate (44%).

4. The only significant uncertainty here is the possibility that rate of inflation will be different than 2%. Our experience would suggest that the actual rate will be between 0% and 4%, a range which would not affect the results above.

SCHEDULE 3

CONTRIBUTION TO OVERHEAD AND PROFIT

Year	Marginal Hour Cost	Price Per Hour	Contribution Per Hour
1	$150	$500	$350
2	153	500	347
3	156	500	344
4	159	500	341
5	162	500	338
6	165	500	335
7	168	500	332
8	171	500	329
9	174	500	326
10	177	500	323

Notes:

1. Out-of-pocket hour costs include employee wages and directly consumable operating supplies. Selling price per hour is that perceived by the management to be prevailing in the market for the output of similar equipment. Both are evaluated as of Year 1.

2. A 2% inflation rate is assumed for out-of-pocket costs consistent with that of Schedule 4. A 0% increase rate is for the selling rate to reflect the inability to pass on all cost increase in later years because of the presence of newer equipment in the market.

3. The only uncertainty here is the assumption about inflation, but it might be noted that changes will tend to cancel themselves out as the schedule seeks the net of costs and prices.

SCHEDULE 4

ANNUAL CONTRIBUTION TO OVERHEAD AND PROFIT

Year	Additional Hours	Contribution Per Hour	Annual Contribution	Contribution Net of Tax
1	600	$350	$210,000	$117,600
2	800	347	277,600	155,456
3	1,000	344	344,000	192,640
4	1,200	341	409,200	229,152
5	1,400	338	473,200	264,992
6	1,500	335	502,500	281,400
7	1,500	332	498,000	278,880
8	1,600	329	526,400	294,784
9	1,800	326	586,800	328,608
10	1,900	323	613,700	343,672
			4,441,400	2,487,184

Notes:

1. The net of tax column is again computed by the use of (1 - t) or 56%.

2. The Additional Hours column shows the annual hours of new presswork coming to the firm as a result of the purchase of the press.

3. The uncertainty to be considered here is the principal uncertainty of the whole analysis, the additional volume assumption. The pre-diction should be supported with as much detail as possible, for example specific customers and jobs that would make up the total.

SCHEDULE 5

SUMMARY OF CASH FLOWS

Year		Discount Rate (15%)	Present Value
Purchase	(2,500,000)	1.000	(2,500,000)
Year 1			
Cost Reduction	60,480		
Capital Cost Recovery	314,270		
Additional Work	117,600		
Total	492,350	0.870	428,130
Year 2			
Cost Reduction	61,690		
Capital Cost Recovery	224,510		
Additional Work	155,456		
Total	441,656	0.756	333,955
Year 3			
Cost Reduction	62,923		
Capital Cost Recovery	160,380		
Additional Work	192 640		
Total	415,943	0.658	273,489
Year 4			
Cost Reduction	64,182		
Capital Cost Recovery	114,400		
Additional Work	229,152		
Total	407,734	0.572	233,123
Year 5			
Cost Reduction	65,465		
Capital Cost Recovery	95,480		
Additional	264,992		
Total	425,937	0.497	211,766
Year 6			
Cost Reduction	66,775		
Capital Cost Recovery	95,480		
Additional Work	281,400		
Total	443,655	0.432	191,804
Year 7			
Cost Reduction	68,110		
Capital Cost Recovery	95,480		
Additional Work	278,880		
Total	442,470	0.376	166,341
Year 8			
Cost Reduction	69,473		
Additional Work	294,784		
Total	364,257	0.327	119,O76
Year 9			
Cost Reduction	70,862		
Additional Work	328,608		
Total	399,470	0.284	113,554
Year 10			
Cost Reduction	72,279		
Additional Work	343,672		
Total	415,951	0.247	102,817
NET PRESENT VALUE OF CASH FLOWS			(325,945)
Undiscounted net cash flows	1,749,423		

AND FINALLY, TAKING A LAST LOOK

After making a decision analysis like those that we have just completed it makes sense to review the results in order to make sure that the assumptions we made about future events were the most reasonable ones given our present knowledge. In doing this our task is simplified by two facts.

First, since the decision is of a "go - no go" nature it is determined by the existence of a positive or negative net present value but it is not affected by its magnitude. Because of this our review need only include those elements that, if wrong, will change the sign of the sum. For instance, we need not consider the possibility that additional sales might not be as planned in our 40" 4c offset press example since a failure will only make the result more negative.

Second, the time value of money insulates us from the effect of future errors; for instance, 75% of all errors of estimate with respect to year 10 were lost through the discounting process (a happy circumstance as our predictive ability usually declines with the length of the prediction).

If our review does not reveal any significant revisions we may conclude that we would not buy the 40" 6c offset press confident that this decision was consistent with rational economic principles and would avoid a decrease in the financial strength of the firm.

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