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Using Probabilities to Make Nursery Budgets More Realistic[1]

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Introduction

We need budgets to run a business so that we, our lenders and other investors can see where we think we are going. A budget is perhaps the best road map for the future there is, so it is vital for a budget to be as realistic as possible. There are two points that are equally important in budgeting. The first point is that no one can predict the future, so we know that our budget is only an estimate. All parties concerned with the firm's future need to understand this. The second point is that we have to alter our budgets as things and times change. Thus, there is not one budget for a firm but a series of them.

Purpose and Procedure

This document is essentially about talking with and educating your lenders. The main purpose is to show how you can incorporate risk into a budget by using probabilities. A probability (Pr) is simply the chance of an event occurring. Tossing a coin has a 50% (0.5) chance of producing heads. We will start with a budget for a plant nursery that makes no allowance for risk, and then incorporate the likelihood of plant deaths and varying cash costs.

The Basic Budget and Terminology

The following budget is for one unit of sales. This might be a single plant, or 10 or 100 plants. The numbers are equally facile. The purpose here is solely to illustrate the methodology (Figure 1).

Plant Budget for August (Dollars per Plant)	
Cash costs	7.00
Depreciation	1.50
Overhead	0.50
Total Costs	9.00
Net Income or ROI (c.11%)	1.00
Therefore, Asking Price Is	10.00

Figure 1. Budget for one unit of sales.

This budget shows that we expect to net $1.00 per plant, or a return of around 11% for our investment. This is the amount that we take to the bank and the basis for requesting a loan. But what happens if we do not get our asking price? This is

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where the "decision tree" comes in so that we have a stronger basis for encouraging our lender to invest in our business. But first, let's make sure we know the terms:

- *Cash costs* are the items for which we pay cash and which will typically account for at least 75% of our costs. They include fertilizers, chemicals, labor, materials, energy costs, rent, repairs and interest. (In this example they also include taxes.)
- *Depreciation costs* are items that depreciate and are usually prorated among sales. These costs generally apply to buildings, machinery and equipment.
- *Overhead costs* are associated with office expenses. They include accountant and legal expenses, office depreciation, business entertainment and travel, as well as the traditional paper, secretarial and phone costs.
- *Net income* is the most important number for any firm. It always shows what is remaining to pay owner's salary and principal on loans and to reinvest in the firm. It can only be spent on these three things for any firm in the world.
- *ROI*, or return on investment, is used here as the percentage difference between total costs and net income. It shows how much return we expect from investing $9.00 in each unit of sales.
- *Asking price* is what we want for selling one unit. It covers all our costs and a reasonable ROI.

Assumptions

We will make the following assumptions for our business:

- Most budgets are like the one above, so we can we expect to make a $1.00 per plant profit. We will spend this dollar on our salary, principal payments and re-investments, which we will show to our lenders and firm investors via cash flows and firm budgets.
- We will negotiate with our customers to be paid our asking price, or $10.
- We can anticipate plant losses.
- We need to concentrate on cash costs because they are our most important costs. Cash costs can vary in the short run (e.g., energy prices), and we can never be certain what these will finally be. Any change will affect our potential net income, so we will use a decision tree to help us think through the problem.

Using Probabilities

Our records and experience suggest that we will have plant losses. To keep things simple, we will only pick two possibilities, namely 4% and 8% losses. Our records show that we are more likely to have smaller than larger losses. Therefore, we decide on the Pr of 70% (0.70) for 4% loss and on the Pr of 30% (0.30) for 8% loss (Figure 2).

Events and Probabilities

Cash Costs	*Pr*	*Losses*	*Pr*
$6.30	0.25	4%	0.70
$7.00	0.50	8%	0.30
$7.70	0.25		

Figure 2. Probabilities chart.

Similarly, although we think our original cash costs of $7.00 will be right 50% of the time, we will include a 10% range at $6.30 and $7.70, with equal chances for either, so that both will have a 25% chance of happening.

Note that these probabilities are our own. They represent the most likely situations according to our experience and preferences. They may not represent the probabilities of others in the same business, but they make us comfortable. This point cannot be emphasized enough. It is vital that these probabilities make sense to us. It will then be our job to explain them to others interested in the firm's progress.

Combining the Data and Probabilities Into a Decision Tree

Obviously, changing cash costs and including losses will affect our original budget. It will also affect our $1.00 per plant net income we estimated and showed the lender. If net income actually falls, it can be serious for the firm if some of it has already been committed for principal payments and reinvesting. This means that the expected salary will be less than anticipated, thereby reducing family living expenses and increasing family grief.

The decision tree illustrates the consequences of including Pr(s) in our budget calculations. This is the work we need to do ***before*** we make our budget, and ***before*** we discuss the consequences of this budget with parties interested in our firm.

This time we want to know the chances of two things happening, rather than one. Thus instead of calculating the Pr of tossing a coin to get tails, we now want to know the Joint Probability (JPr) of tossing tails twice in a row. This JPr is found by multiplying the individual probabilities together. So what is the JPr of tossing tails twice in a row? Each individual tail has a 0.50 probability, so tails twice in a row have 0.50 x 0.50 = 0.25 chance of happening (1 chance out of 4) in the long run. Figure 3 illustrates how we can apply the same argument to our situation.

Cash Cost	Pr	Loss	Pr	Net Income	Joint Pr
$6.30 →	0.25	→ 4%	0.7	$1.35	0.175
		→ 8%	0.3	$0.98	0.075
$7.00 →	0.50	→ 4%	0.7	$0.63	0.350
		→ 8%	0.3	$0.22	0.150
$7.70 →	0.25	→ 4%	0.7	($0.10)	0.175
		→ 8%	0.3	($0.46)	0.075
					1.00

Figure 3. Decision Tree.

Figure 3 also shows the results of combining expected losses with varying cash costs and their joint effect on net income per sales unit. This illustrates that under our postulated events, net income can vary from a negative $0.46 per unit to a positive $1.35 per unit.

Conclusion

We found that the original budget, without risk, showed that we expected $1.00 net income per plant, or 11% ROI, from our $9.00 investment.

By using reasonable probabilities for losses and varying cash costs, our new budget can show the following:

- We get $1.00 or more net income only 17.5% of the time
- We get less than a $1.00 net income, but we still get a positive net income 57.5% of the time
- We get a loss 25% of the time

We should focus on the methodology, rather than on the numbers. Changing numbers obviously changes results.

Because this tool has almost limitless possibilities, we can run an array of losses or costs, or change these to returns or yields, or whatever we like. All major firms use a decision tree in some form and so should we.

Perhaps the main question to ask from these results is whether we should even produce this item. The results show that we will make a positive ROI 75% of the time. Or looked at another way, we make a loss one out of four times, which means that we are probably left with four alternatives:

1. Do the numbers again.
2. Substitute another enterprise.
3. Do not produce if alternatives one and two cannot improve the situation.
4. Forget the numbers and trust to luck.

Unfortunately, those of us who pick alternative four will not be around for long

The difference between our original budget and the results of the decision tree are significant. Owners, firm investors and lenders should be a lot more interested in the variation of the postulated results than in a forecast that is "cast in concrete."

Table 1. Calculations for the decision tree.

Look at the first row only

1. The JPr is calculated by multiplying 0.25 x 0.7 = 0.175 or 17.5%

2. (6.30/0.96) + (2/0.96) = total cost of $8.65
   $10.00 asking price – $8.65 = $1.35 net income

3. *Logic*
   1. $6.30 only produces 0.96 of a plant.
   2. $2.00 is depreciation plus overhead, which also only produces 0.96 of a plant.
   3. We will get $1.35 net income 17.5% of the time, or nearly one out of six times.

Row Two

1. The JPr is 0.25 x 0.3 = 0.075 or 7.5%

2. *Logic*
   1. $6.30 now only produces 0.92 of a plant.
   2. $2.00 also now only produces 0.92 of a plant.
   3. We get $0.98 net income 7.50% of the time, or about one out of 13 times.
      Or, combining rows one and two, we almost get $1.00 or more net income only 25% of the time.
      Compare this statement with our original budget.

Repeat this procedure for the other rows