## Cost and Returns Estimation or Enterprise Budgeting or Cost Center Analysis

## Resources:

http://www.cals.uidaho.edu/aers/r_crops.htm
http://www.cals.uidaho.edu/aers/r_livestock.htm
http://extecon.wsu.edu/pages/Enterprise_Budgets
http://arec.oregonstate.edu/oaeb/

## Purpose of Enterprise Budgeting

- Pricing decisions
- Marketing decisions
- Changing production practices
- Determining product mix
- Adds up to whole firm analysis

## Cost and Return Budget Format "Per Unit "

- Gross Returns
- Operating Costs
- Ownership Costs
- Net Returns to ...

## Costs

- Operating or variable
- Ownership or fixed

## Costs

- Opportunity costs
  - What is the cost of management?
  - What is the cost of hay transferred from a haying enterprise to a beef cow enterprise?

## Costs

- Operating capital
  - Expense is the interest on capital tied up in operating expenses
  - Loan rate or opportunity cost?
  - Time frame?

## Costs

- Overhead
  - Allocated across all enterprises

## DIRTI and DITHI Methods

Convert the cost of owning and operating a long-term asset to an average annual cost

These average long-term annual costs can then be used with other annual operating costs and returns to examine total costs and returns for an enterprise.

## Ownership Costs of Buildings

- DIRTI FIVE:

- D =
- I =
- R =
- T =
- I =

## Ownership Costs of Machinery

- DITHI FIVE:

- D =
- I =
- T =
- H =
- I =

## DITHI Method: D

Depreciation—straight line

$$D = \frac{\text{Current Purchase Price} - \text{Salvage Value}}{\text{Years of Life (or use)}}$$

## Depreciation Example:

- Truck: $30,000
- Useful Life: 5 yrs
- Salvage Value: $7,000

$$D = \frac{30{,}000 - 7{,}000}{5}$$

$$= \$4{,}600$$

## Depreciation

- Economic depreciation = Tax depreciation?

## DITHI Method

Average invested capital (AIV): average amount of capital committed to the investment over its expected period of use

$$AIV = \frac{\text{Current Purchase Price} + \text{Salvage Value}}{2}$$

## DITHI Method

Example:

$$AIV = \frac{30{,}000 + 7{,}000}{2} = 18{,}500$$

30,000 + 25,400 + 20,800 + 16,200 + 11,600 + 7,000

= 111,000/6 = 18,500

## DIRTI Method: I

Opportunity costs of invested capital:

I = AIV * annual interest rate

Example:

I = 18,500 * 0.04 = $740

## What interest rate should you use in the AIV formula?

- Nominal rate?
- Real rate?

## What interest rate should you use in the AIV formula?

- No consensus answer. Different views persist.
- In periods of low inflation, the choice makes little difference.
- Choice between "borrowing rate" and "investing rate" also makes a difference.

## What interest rate should you use in the AIV formula?

- Make your choice and be consistent.

## Capital Recovery Charge (CRC) = D + I

$$\frac{V_0 - (V_n/(1+i)^n)}{[1 - (1/(1+i)^n)]/\ i}$$

$V_0$ = asset cost at beginning of year 1
n = life of asset in years
$V_n$ = value of asset at the end of useful life
i = interest rate

## CRC example:

$$\frac{30{,}000 - [7{,}000/(1.04)^5]}{[1 - (1/(1.04)^5]/\ .04)}$$

= $5,446.45

Recall traditional method =
D + I = 4,600 + 740 = $5,340

## DITHI Method: Remaining machinery and fixed costs (traditional and CRC)

THI: taxes, housing, and insurance
often figured as a single rate

Some texts use overall average rate of .028 of average value for THI

Formula:
THI = AIV * Rate = $18,500 x 0.028 = $518

## DITHI Method

Average Fixed Costs per Year:

| | |
|---|---|
| Depreciation | $4,600 |
| Interest on Inv | 740 |
| THI | 518 |
| Total | $5,858 |

## DITHI Method: Remaining machinery and fixed costs (traditional and CRC)

You can tailor THI costs to specific equipment (WSU extension publication)

T = 1.4% of AIV (WA average – Idaho?)

H = 0.2% for crawler tractor to 2.4% for drills

I = 0.6% for tillage equipment to 2.1% for combine

You can substitute in your own exact costs if you have good records or quotes from local suppliers.

## Buildings: Fixed costs only, no variable costs (traditional method).

$$D = \frac{\text{(Purchase Price – Salvage Value)}}{\text{Years of Use}}$$

$$I = \frac{\text{(Purchase Price + Salvage Value)}}{2} \times \text{Interest Rate}$$

R = Approximately 2% of original cost each year

T & I = Varies by region and type of building

## Machinery Operating Costs

- FLRML Five
  - Fuel
  - Lube
  - Repairs
  - Materials
  - Labor

## Machinery Operating Costs

- Operating or variable costs of machinery operations (should substitute your own history for formulae if you have good records).
  - Fuel

    e.g., gal diesel/hr = 0.044 x Max PTO HP; (B&E p. 146)

    e.q., Fuel use = hours use x FC x horsepower x fuel price ($/gal)

    300 x 0.044 x 130 x $1.02 = $3,342

## Machinery Operating Costs

- Lubrication cost/hr = 0.15 x (fuel cost/hr)

= 0.15 * 3,342 = $501

## Machinery Operating Costs

- Repairs and maintenance: engineering formulae based on total accumulated use hours and type of machine

[New purchase cost x $RC^1$ x (lifetime use (hr) /1000)$^{RC2}$]/ Years of use

= [$30,000 x 0.0120 x (2400/1000)$^{2.033}$]/8
= $267

## Machinery Operating Costs

- Materials: (Rates x Prices)
- Labor costs/ac. = (wage & benefits per hour) x (hours field & non-field time) / acres

## Land Costs (fixed only, there are no variable costs)

- Which of the "DITHI Five" of Machinery fixed costs exist for land?
  - Depreciation?
  - Interest?
  - Taxes?
  - Housing?
  - Insurance?

## Land Costs (fixed only, there are no variable costs)

- I = Interest (op cost) on land used for farming, if owned, or real cost (rent) of rented land.
  - B&E: I = (real i) x (current market value for owned land)
  - WSU Ext. uses: "net rent" foregone by farming land yourself rather than renting it out.

  e.g. $100/ac rent – $10 property taxes = $90 net rent foregone

## Land Costs (fixed only, there are no variable costs)

- T = Taxes = (farm use) valuation x local property tax rate {avg. of 1.4% of avg. value in PNW}

## Other Costs

- Management Costs:
  - Some texts recommend 7% of the expected gross returns based on typical charges of professional farm management services.
  - Some budgets do not include a charge for management—part of the residual "net return".
- Overhead and Miscellaneous
  - Includes utilities, legal fees, crop insurance, and other items not accounted for above.

## Profitability Measures:

- "Profit" is an elusive word. It should always be precisely defined, as there are several different "profit" concepts.
- Profit can be defined as: profit or net returns over specified costs, such as
  - Returns over variable costs
  - Returns over cash costs
  - Or as net returns (profit) to specified inputs

## Returns Attribution Principle

"RETURNS ARE ATTRIBUTED TO THOSE INPUTS WHICH ARE NOT COSTED OUT IN THE BUDGET."

Example:

No charges for operator's labor, management, and equity in land and machinery investment, then…

"Profit" represents "returns to operator's labor, management and equity".

## Returns Attribution Principle

Example:

If all inputs are assessed costs except for the operator's labor and management, then…

"Profit" represents "returns to operator's labor and management".

## Cost of Production

- The average cost of producing one unit of the product
- Cost of Production = $\frac{\text{Total Cost}}{\text{Expected yield}}$
- A profit is made when the product can be sold for more than its cost of production.

## Revenues

- What unit of measurement?
  - Crops?
  - Livestock?

## Example—Crop Farm

- Share crop: 1/3 crop receipts to landowner
- 70 bu/acre at $5.50/bu
- Landlords share of fertilizer: 1/3
- Total fertilizer cost per acre per year: $62.00

## Revenues

- Cow-calf operation—per head
  - Total # steer calves sold
  - Total # heifer calves sold
  - Total # replacements culled and sold
  - Total # culls sold
  - Total # bulls sold
- Divide each by total # of cows in herd

## Example—250 cow beef herd

- 35 bred replacement heifers ($1,000) are purchased annually to replace cull cows and cover death loss.
- 35 cows are replaced annually; 33 are culls (11 cwt @ $0.55/lb) and two account for death loss.
- A 94% calf crop is achieved.
- Weaning weights are steers, 635 lbs ($1.20); heifers, 575 lbs ($1.15)
- Three bulls are used for three years each. One bull is bought and sold annually ($2,500 and $1,100).
- Four horses are used for four years each. One is purchased ($2,500) and one sold ($1,000) yearly.

## Break-Even Yield

- The yield necessary to cover all costs at a given output price.
- Break-even Yield = $\frac{\text{Total Cost}}{\text{Output Price}}$

## Break-Even Price

- The output price necessary to just cover all costs at a given output level.
- Break-even Price = $\frac{\text{Total Cost}}{\text{Expected Yield}}$

## Break-Even Point

- Defines when an investment will generate a positive return.

- Break-even = $\frac{\text{Total Fixed Costs}}{(S - V)}$

S = Savings or additional returns per unit of production

V = variable costs per unit of production

## Break-Even Point Example
**(buy combine or custom harvest)**

- Fixed Costs = $21,270/year
- Variable Costs = $8.75/hr / 5 ac/hr
  = $1.75/ac
- Savings = $16/ac (custom operator) if don't custom harvest

- Break-even = $\frac{\$21,270}{(\$16 - \$1.75)}$
  = 1,493 acres

## Break-Even Point Example
**(own harvest saves 2 bu wheat/acres)**

- Additional income = $4/bu * 2 bu/ac
  = $8/Ac

- Break-even = $\frac{\$21,270}{(\$16 + \$8 - \$1.75)}$

= 956 acres

## Break-Even Analysis and Marketing Risk Management

- Why should you know your production costs?
  - Marketing success is known when a particular price offers an opportunity for profit.
  - Therefore, knowing production costs is an essential marketing tool. If you know your cost of producing a crop, you have a concrete foundation for evaluating the prices being offered by the market.

## Break-Even Analysis and Marketing Risk Management

- Watch for a profit, not the top of the market!
- Avoid the trap of just trying to hit the top of the market. The top may not even be profitable for you. NOBODY can tell you when you are at the top!