Cultivating Success
Enterprise Budgeting: Purpose and Methods

Dr. Michael Brady
Dr. Karina Gallardo

School of Economic Sciences
Washington State University
The primary use of an enterprise budgets is to give an estimate of expected profit per unit of production for a particular enterprise.

What is an enterprise:
- An enterprise is the production of a single crop or livestock.

What is a budget:
- A budget is an analysis of the profitability of a production plan.
Purpose

- Their “per unit” basis is why enterprise budgets are so widely used:
  - Crop enterprise budgets are typically done by acre.
  - Livestock budgets are typically done by head.

- Enterprise budgets are useful for
  - A producer to compare their costs and returns relative to what is considered “typical”.
  - A producer considering incorporating a new enterprise into their operation.
Purpose

• Enterprise budgets are also the foundation for other types of budgets
  – Cash flow budgets
    • Analyze the timing of costs and revenues during the production year.
  – Partial budgets
    • Analyze whether a particular action makes financial sense.
  – Whole farm budgets
    • Analyze the profitability and feasibility of complete production plan.
Economic vs. Cash Budgets

- Economic budgets value all factors of production even if they are not associated with a cash expense.

- If returns are positive then the operation is profitable and you are earning returns to risk and management.

- If returns are negative then you would be making more money by investing assets elsewhere.

- A cash budget only includes actual cash payments for labor, land, and machinery.

- Cash budgets say whether you are making a positive return but do not say whether your investment in the farm is earning a greater return than the best alternative.
Parts of an enterprise budget

- Assumptions
- Revenue
  - price
  - yield
- Operating or variable costs
- Fixed or ownership costs
- Comparison of revenue and costs
  - Returns over variable costs
  - Profit per unit
- Break-even analysis
Table 2. Cost and Returns per Acre of Establishing, Producing and Packing Gala on a 40-Acre Orchard Block

<table>
<thead>
<tr>
<th></th>
<th>Establishment Years</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
<td>Year 3</td>
<td>Year 4</td>
</tr>
<tr>
<td>Estimated Net Production (bins/acre)</td>
<td>16.00</td>
<td>28.00</td>
<td>40.00</td>
<td>52.00</td>
<td></td>
</tr>
<tr>
<td>Estimated FOB Price ($/bin)</td>
<td>530.00</td>
<td>530.00</td>
<td>530.00</td>
<td>530.00</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL RETURNS ($/acre)</strong></td>
<td>8,480.00</td>
<td>14,840.00</td>
<td>21,200.00</td>
<td>27,560.00</td>
<td></td>
</tr>
</tbody>
</table>

**Variable Costs**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment</td>
<td>9,491.54</td>
</tr>
<tr>
<td>Orchard Activities</td>
<td>1,599.00</td>
</tr>
<tr>
<td>Harvest Activities</td>
<td>690.00</td>
</tr>
<tr>
<td>Warehouse Packing Charges</td>
<td>3,843.00</td>
</tr>
<tr>
<td>Maintenance and Repairs</td>
<td>253.50</td>
</tr>
<tr>
<td>Other Variable Costs</td>
<td>1,162.76</td>
</tr>
<tr>
<td><strong>Total Variable Costs</strong></td>
<td>12,506.80</td>
</tr>
<tr>
<td><strong>Total Fixed Costs</strong></td>
<td>1,922.39</td>
</tr>
<tr>
<td><strong>TOTAL COSTS ($/acre)</strong></td>
<td>14,429.19</td>
</tr>
<tr>
<td><strong>ESTIMATED NET RETURNS ($/acre)</strong></td>
<td>-14,429.19</td>
</tr>
</tbody>
</table>
As is true in all industries, farm operations vary greatly along a number of dimensions. Every enterprise budget makes a set of assumptions about factors that influence profitability.

- Price received
- Yield
- Costs
Assumptions

- Factors that influence cost per unit
- Farm size assumption
  - Economies of scale
- Enterprise mix
  - Economies of scope


- The area of the total farm operation is 300 acres. Bearing acres include 225 acres of apples (75% of total area), 48 acres of sweet cherries (16%), and 27 acres of pears (9%).

- This budget is based on a 42-acre Gala block within a 300-acre diverse cultivar orchard. It is assumed that 2 acres of this block are not used for the direct production of tree fruit; rather, they are dedicated to roads, a pond, loading area, etc. Therefore, the total productive area for this block is 40 acres. Table 1 shows the assumed Gala block specifications.

- The value of bare agricultural land (including water rights) is $12,000 per acre with annual property taxes of $120 per acre.

- The irrigation system consists of overhead cooling and under-tree drip sprinklers, with two separate sub-main lines. Water is provided through a public irrigation district.

- The pond is installed in Year 1.

- Warehouse packing charges assume a 925-lb bin. There is no pre-sorting of apples in the field, thus the grower gets charged for the 925-lb packed bin that will include pack-outs and culls.

- Cultural practices and harvest activities are done by hand and using ladders (no platforms).

- Management is valued at $300 per acre. This value is representative of what the producer group felt as a fair return for an operator’s management skills.

1. Interest on investment is 5%.
Revenue

- Price and yield should reflect “best guess”.
- Variability in price and yield is the reason for break-even analysis.
<table>
<thead>
<tr>
<th></th>
<th>Establishment Years</th>
<th>Full Production^A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
</tr>
<tr>
<td>Estimated Net Production (bins/acre)^B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated FOB Price ($/bin)^C</td>
<td>530.00</td>
<td>530.00</td>
</tr>
<tr>
<td><strong>TOTAL RETURNS ($/acre)</strong></td>
<td>8,480.00</td>
<td>14,840.00</td>
</tr>
<tr>
<td><strong>Variable Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establishment^D</td>
<td>9,491.54</td>
<td></td>
</tr>
<tr>
<td>Orchard Activities^E</td>
<td>1,599.00</td>
<td>1,950.00</td>
</tr>
<tr>
<td>Harvest Activities^F</td>
<td>690.00</td>
<td>1,207.50</td>
</tr>
<tr>
<td>Warehouse Packing Charges</td>
<td>3,843.00</td>
<td>6,725.25</td>
</tr>
<tr>
<td>Maintenance and Repairs^G</td>
<td>253.50</td>
<td>263.50</td>
</tr>
<tr>
<td>Other Variable Costs^H</td>
<td>1,162.76</td>
<td>226.88</td>
</tr>
<tr>
<td><strong>Total Variable Costs</strong></td>
<td>12,506.80</td>
<td>2,440.38</td>
</tr>
<tr>
<td>Total Fixed Costs^I</td>
<td>1,922.39</td>
<td>2,643.85</td>
</tr>
<tr>
<td><strong>TOTAL COSTS ($/acre)</strong></td>
<td>14,429.19</td>
<td>5,084.23</td>
</tr>
<tr>
<td><strong>ESTIMATED NET RETURNS ($/acre)</strong></td>
<td>-14,429.19</td>
<td>-5,084.23</td>
</tr>
</tbody>
</table>
Operating expenses

- Operating expenses are typically straightforward, which includes items like feed, seed, fertilizer, pesticides, fuel, and paid labor.

- These prices are often variable and may require significant guesses.
Machinery operating costs

- Sources of machinery operating costs
  - Fuel and lubrication
  - Repair and maintenance
  - Labor
  - Depreciation
Machinery operating costs

- Easy to calculate $/hr.
- But, units need to be $/acre.
- Calculate acres/hr:
  – (miles/hr)x(ft/mile)x(machine width in ft.)/(sq. feet per acre)
  – (Speed x 5,280 x Width)/43,560
- Take the inverse to get hr/acre
- Multiplying ($/hr)x(hr/acre) $/acre
Machinery operating costs

- **Fuel and lubrication**
  - Depends on size, load, speed, and field conditions.

- **Fuel costs per hour**
  - Based on the maximum power takeoff horsepower (PTO) in the following way.
  - Gasoline gallons per hour = 0.060 x PTO
  - Diesel gallons per hour = 0.044 x PTO
  - Example: 180 PTO diesel tractor x 0.044 = 7.92 ga/hr.

- Calculate fuel cost per hour by multiplying by fuel price per gallon.

- Lubricants and filter costs are assumed to be 10 to 15% of fuel costs.
• Repairs
  – Repairs are usually calculated per 100 hours of use.
  – Standard reference is “Farm Power and Machinery Management” by Donnell Hunt.
  – Repairs example: Tractor with list price of $150,000 and repair factor of 0.5% has an average annual repair cost per 100 hours of use of $150,000 x 0.005 = $750.
Machinery operating costs

• Labor
  – Estimate machinery hours of use.
  – Labor time is typically assumed to be 110% of machinery time.
  – Multiple labor time by typical wage rate.
Machinery operating costs

- **Depreciation**
  - Need to allocate machinery depreciation to specific enterprises.
  - **Step 1:** compute average annual depreciation on each machine
  - **Step 2:** convert depreciation to per-acre or per-hour value based on acres or hours used per year.
  - **Step 3:** pro-rate to enterprises based on amount of use.
Ownership costs are more complicated because they have to be “annualized”.

For example, the cost of a tractor has to be converted to a per time and per acre basis.

Specific items
- Housing costs
- Insurance
- Interest
Machinery ownership costs

- Housing costs
  - Typically assumed to be 1% of the average value of the machine.
  - More precise calculation based on square footage can be done.

- Insurance
  - Often assumed to be 0.5% of the machine's average value.

- Interest expense
  - Use the average interest expense \( = (\text{avg. value}) \times \text{rate} \)

- Average value calculation
  - \( \text{avg. value} = (\text{Initial value} + \text{salvage value})/2 \)
Livestock budgets

- More difficult to choose
  - Unit of production
  - Production cycle
- Less than a year (finishing) or more than a year (breeding).
- Multiple products that generate revenue
- Must account for herd replacement whether they are raised or purchased.
- Account for farm-raised feed that should be valued at opportunity cost.
Perennial crop budgets

- The key challenge with perennial crop budgets is establishment costs.
- Spread out costs over production period using amortization.
- Similar to a home loan, spread the cost out over a certain time horizon.
- Even if money is not borrowed, an economic budget includes interest to account for opportunity costs.
- Cash flow analysis is particularly critical for perennial crop production.
Amortization formula

- \( Ann = EC \times \frac{i}{1-(1+i)^{-n}} \)
- Ann = annualized cost
- EC = establishment costs
- i = interest rate
- n = number of years
Break-even analysis

- Break-even analysis is the first step in accounting for price and yield uncertainty.

- Asks the question, what is the lowest price or yield that will allow me to just break-even?

- Revenue = Production Costs
  - Price x Yield = Costs
  - Price = Costs/Yield
  - Yield = Costs/Price
Break-even analysis

• What if there are two sources of revenue?

• Revenue = Costs
• Price(1) x Yield(1) + Price(2) x Yield(2) = Costs
• Assume values for costs and 3 of the other 4 values.
• Calculate break-even price for revenue source 1
  – Price(1) = (Costs – Price(2)xYield(2))/Yield(1)
Break-even values become much more powerful when combined probabilistic information.

“What is the probability that I get a price or yield below the break-even value?”

Sources of data:
– Your own farm
– USDA NASS
– Neighbors
– Commissions
– WSU Extension
Using probabilistic information in break-even analysis

- Use histograms that count share of observations in a range.
- Add up height of bars from left to right to estimate probability of observing value below some threshold.
- For price histograms on next page the red bars break down the first bar into five segments.
### Table 3. Estimated Net Returns ($) per Acre at Various Prices and Yields of Gala during Full Production

<table>
<thead>
<tr>
<th>Net Yield (bins/acre)</th>
<th>FOB Price ($/bin)</th>
<th>$400</th>
<th>$440</th>
<th>$480</th>
<th>$520</th>
<th>$560</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td></td>
<td>-$4,220</td>
<td>-$2,300</td>
<td>-$380</td>
<td>$1,540</td>
<td>$3,460</td>
</tr>
<tr>
<td>56</td>
<td></td>
<td>-$3,489</td>
<td>-$1,249</td>
<td>$991</td>
<td>$3,231</td>
<td>$5,471</td>
</tr>
<tr>
<td>64</td>
<td></td>
<td>-$2,758</td>
<td>-$198</td>
<td>$2,362</td>
<td>$4,922</td>
<td>$7,482</td>
</tr>
<tr>
<td>72</td>
<td></td>
<td>-$2,027</td>
<td>$853</td>
<td>$3,733</td>
<td>$6,613</td>
<td>$9,493</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>-$1,296</td>
<td>$1,904</td>
<td>$5,104</td>
<td>$8,304</td>
<td>$11,504</td>
</tr>
<tr>
<td>88</td>
<td></td>
<td>-$565</td>
<td>$2,955</td>
<td>$6,475</td>
<td>$9,995</td>
<td>$13,515</td>
</tr>
<tr>
<td>96</td>
<td></td>
<td>$166</td>
<td>$4,006</td>
<td>$7,846</td>
<td>$11,686</td>
<td>$15,526</td>
</tr>
<tr>
<td>104</td>
<td></td>
<td>$897</td>
<td>$5,057</td>
<td>$9,217</td>
<td>$13,377</td>
<td>$17,537</td>
</tr>
</tbody>
</table>
Enterprise budgets are the key input into all other types of budgets.

They are useful for producers already in an enterprise and those thinking of entering.

Each enterprise is unique and will require a significant amount of work to understand all the details.
Thank you

Questions?