

# Cost of Production

Versus

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And then there is,

# Cost of Production!

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## **Introduction**

Historically business advisors have encouraged farm managers to determine, know and utilize the cost of production in making business decisions. While this is excellent advice, the devil is in the implementation. For the single product enterprise such as wheat grain or a hog or steer feeder to finish operation, the approach is fairly straight forward. Gather the cash costs associated with the business, make a couple of accrual (inventory change) adjustments and divide by the number of units produced/sold. The result can be compared directly to the price of the product, i.e. if the price is higher than the costs per head, or bushel produced/sold you are profitable, if not; you are not profitable.

Determining the relationship between cost of production and the product's price in joint product enterprises can be more difficult. A joint product enterprise is where two or more products are produced (for example wheat grain and wheat straw) by one production process. In these cases the costs associated with the production of each individual product cannot be easily obtained. There are several methods for calculating cost of production and this paper will look at three old standbys plus reintroduce the *Per Dollar or Percent of Gross Revenue* method.

Another complicating factor is specifically how the information generated will be used. Cost of production information can have multiple uses and there are several options to determining cost of production. Can intended use of the cost of production information be matched up with an appropriate calculation method?

## **Uses for Cost of Production Information - *What is your Purpose?***

The primary applications for cost of production information are in management decision making pertaining to cost control and to guide purchase and marketing options. This decision process involves asking and answering the questions; “What if?” and, “What now?” When comparisons of performance of the present are made to total income, the market price received or offered, with previous years, other farms or projected into the future, the level of risk and identification of opportunity is clarified.

But, how you approach the calculation, what costs you include and which ones you don't depends on the purpose you have for the information relative to the decision to be made. For example, cost of production determination helps to answer the management questions;

- “Did I make money?”
- “Am I competitive with other businesses like mine?”
- “Is the market offering a favorable price for my product?”
- “Is the market offering prices of inputs that may allow me to produce at a profit?”

Cost of production information supports decisions such as;

- “Should I stay in this enterprise or business?”
- “If I exit this enterprise or business, how do I do so to maximize the retention of equity?”
- Making changes to the business or enterprise.
  - Reduce or increase the number of enterprises
  - Reduce or expand the scope of an enterprise
- Hedge feed or other input costs.
- Hedge milk income prices.
- Document profitability.
- Change quality of life.
  - Hire additional labor
  - Hire management services
  - Increase family living draw
  - Take more time off

So where you start actually begins with where you want to end. The choice of the calculation method depends on the purpose. State your purpose then choose your weapon! The following are a few example purposes matched with the recommended cost of production calculation approach.

### Cost of Production “Tool” Selection Grid

<i>Purpose</i>	<i>Tool</i>
Document profitability *	Whole Farm Enterprise
Compare my performance to others *	Whole Farm; CWT EQ. “All Milk Price”
Compare my performance to previous years *	“ “ or your own price
Satisfy a lender *	Whole Farm; positive cash margin
Did I make any money last year? *	Whole Farm analysis
Am I likely to make money next year? *	“ “projection compared to analysis
Is feeding out dairy steers profitable? *	Enterprise analysis or projection
Expand or contract the business or enterprise *	Whole Farm or enterprise analysis & Projection
Lock in Soybean Meal prices? *	“ “
Lock in milk price? What is a good milk price? *	Whole Farm COP; Basic, Allocated, Allocated plus family living\ future investment
Accept offered futures price *	Whole Farm or enterprise; CWT EQ., “All Milk Price” or your own price
Change quality of life*	Whole Farm COP; Basic, Allocated, Allocated plus family living\ future investment

**\* Each of the above may be calculated using the Per-Dollar or Percent of Revenue approach as well as the unit of production option.**

Which cost items do I include? As mentioned earlier, first identify and state your purpose.

### Cost of Production “Cost” Selection Grid

<i>Purpose</i>	<i>Costs to Consider</i>
Continue in business in the short run?	Include all variable costs.
Can I pay my bills and interest costs on loans?	Add in interest cost with variable\Basic.
Can I pay my bills, interest and labor costs?	Labor + Interest +variable\Basic costs.
Can I pay principle payments on time?	Add scheduled principle payments to above.
Can I also contribute to family living?	Add family living draw to above.
Replace or update equipment or pay for the kid’s college or a vacation?	Add in new purchases/expenditures to above.

## Calculation Methods Available

Four methods will be discussed. They include

1. **Per Dollar or Percent of Revenue**
2. **Per Unit Sold**
3. **Residual Claimant**
4. **Equivalent Production**

### Example Enterprise

A wheat enterprise, in some parts of the world, is a joint product enterprise. The joint products are wheat grain and wheat straw. The major product is wheat grain but wheat straw can be harvested and sold.

The facts are:

Wheat grain yield 50 bushel per acre

Wheat straw yield 0.8 tons per acre

Seed Costs \$20.00 per acre

Fertilizer \$40.00 per acre

Fuel \$10.00 per acre

Chemicals \$20.00 per acre

Other \$30.00 per acre

Total Operating Costs \$120.00 per acre

Land Costs \$50.00 per acre

Machinery \$20.00 per acre

Labor \$10.00 per acre

Management \$10.00 per acre

Total Overhead Costs \$90.00 per acre

Total Costs \$210.00 per acre

Wheat grain price \$4.00 per bushel

Wheat straw price \$50.00 per ton

Given these facts, what is the seed cost per bushel of wheat grain? What is the total operating cost per bushel of wheat grain? What is the total overhead cost per bushel of wheat grain? What is the total cost of production per bushel of wheat grain? <sup>1</sup>

### Per Dollar or Percent of Revenue

The complications faced and explanations offered to deal with the various cost of production methods are in large part due to our historic desire to put cost of production in units of the standard amounts/weights of product produced/marketed. The alternative is a method used

by almost every other business - costs Per Dollar or Percent of Revenue. With this method it doesn't matter whether the price between years or farms is the same, the results are comparable.

To use this method a divisor must be calculated. The divisor is "Total Enterprise Revenue". In our example it equals \$240 (wheat grain income ( $\$4.00 \times 50 \text{ bu.} = \$200$ ) plus the wheat straw income ( $\$50 \times 0.8 \text{ T} = \$40$ ).

Using this method the "Total Enterprise Revenue" is divided into the cost items/categories. The seed cost ( $\$20/\text{acre}$ ) is 8.33 cents per dollar or 8.33 percent of revenue ( $\$20/\$240$ ). The operating costs ( $\$120$ ) are 50 cents per dollar or 50 percent of revenue ( $\$120/\$240$ ). Overhead costs ( $\$90$ ) are 37.5 cents per dollar of revenue ( $\$90/\$240$ ) and total costs ( $\$210$ ) are 87.5 percent of revenue ( $\$210/\$240$ ). The profit to the enterprise is 12.5 percent of revenue ( $(\$240 - \$210 = \$30.00)/\$240$ ) or  $(1 - 0.875 = 0.125)$ .

But what do I do with these results? For the example, my total costs are 87.5% of my Total Gross Revenue so, what does it mean? It means simply that you are competitive with those whose costs are above 87.5% and less so with those who's are below. The percent of gross revenue approach recognizes the number one goal of business, to create wealth. Productivity and profitability measures are now in terms of dollars produced versus bushels, tons, pounds or CWT of produce marketed. *With cost of production as a Per-Dollar or Percentage of Gross Revenue value, the relationships between costs and sales are automatic.*

## **Per Unit Sold**

This is the cost of production method commonly used with single product enterprises. The divisor in this method is the number of units of the major product that were produced by the single or joint product enterprise.

The main advantage of this method is it is an extension of the single product enterprise method and familiar to most individuals so knowledge of another method is not required.

Also, it is easy to determine the divisor, just use the number of units of the major product produced. In this example, that number is 50. In addition, it seems as if you don't need to know the price of the outputs to calculate the cost of production.

The problems with this method are determining the cost per unit of individual expense items (such as seed) and comparing the cost of production to the price received per unit. The cost of seed per bushel, using this method, would be  $\$0.40$  ( $\$20 / 50$ ).

However that implicitly says that none of the seed was required to produce the straw. This is probably untrue, but usually it is not possible to separate the seed costs between those required to produce grain versus straw.

This problem, of allocating all the costs of production to the major product, continues even when all costs are considered. Using the example, the operating cost per bushel of wheat grain is  $\$2.40$ ; the overhead cost of production per bushel is  $\$1.80$ ; and the total cost of

production per bushel is \$4.20 ( $\$210 / 50$ ). This is greater than the price received per bushel (\$4.00); therefore the producer might be lead to the conclusion that the wheat enterprise is unprofitable. However, if the enterprise is examined on a per acre basis ( $\$240$  income -  $\$210$  costs =  $\$30$  profit), this proves to be untrue.

This is the major problem with this method. The cost of production per unit **cannot** be compared to the price received. The cost of production must be compared to some other unit of revenue. This new unit of revenue is called “Income per Unit (of major product sold).” It is calculated by adding the income from the sale of all the products and dividing by the number of major product units produced. In the example, the income from the sale of all the products is  $\$240$  (wheat grain income ( $\$4.00 \times 50 = \$200$ ) is added to the wheat straw income ( $\$50 \times 0.8 = \$40$ )). This is divided by the 50 bushels of wheat grain produced and the Income per Unit is  $\$4.80$ .

**The cost per unit calculated using this method must be compared to the Income per Unit, not to the price received per unit of major product sold.**

If that comparison is used ( $\$4.80$  income per unit -  $\$4.20$  cost per unit =  $\$0.60$  and  $\$0.60$  times 50 bushels =  $\$30.00$  profit), the enterprise is correctly identified as profitable. The enigma is that an individual unfamiliar with the necessity to calculate “Income per Unit”, will compare the cost of production calculated using this method to the price of the major product. This gives producers incorrect information on which to base production, marketing, hedging, forward contracting, or other decisions. <sup>1</sup>

## **Residual Claimant**

When using this method, the income from the sale of the joint product(s) is subtracted from the total cost and the remaining cost is divided by the units produced (of the major product). In the example,  $\$210$  cost -  $\$40$  of straw income =  $\$170$  of residual costs. The divisor in this method is the number of units of the major product. In this case the residual costs of  $\$170$  are divided by 50 bushels of wheat grain produced to equal a total cost of production of  $\$3.40$  cost per bushel.

This method allows the comparison between the cost per bushel and the price per bushel of wheat grain. The profit per acre is the wheat price per bushel ( $\$4.00$ ) minus the cost per bushel ( $3.40$ ) times the number of bushels sold (50). Doing this calculation yields a profit per acre of  $30.00$ . One of the advantages of this method is the total cost of production can be compared to the price of the major product.

However, it has disadvantages especially if the components of the cost of production need to be calculated. How should the operating cost of production per bushel be calculated? The operating costs were  $\$120$  per acre. Should some of the straw income be subtracted from that value before dividing by the bushels produced? If so, how much is subtracted?

This problem is further compounded if the value of various individual cost items must be calculated. Example: what is the seed cost per bushel? Also, this method implicitly sets the profit on all non-major products to zero.<sup>1</sup>

## **Equivalent Production**

To use this method a new divisor must be calculated. The new divisor is the number of units of the major product the enterprise would have had to produce in order to have the same income as it has now. In other words, if this were not a joint product enterprise, how many units of the major product would it need to produce to obtain an identical income?

The formula for calculating the equivalent units of production is: Total Enterprise Income (from all products) divided by the Price of Major Product. In the example, the equivalent bushels are 60 ( $\$240 / \$4.00$ ). In other words, this enterprise could produce 50 bushels of wheat grain **and** 0.8 tons of wheat straw or 60 bushels of wheat grain and have identical income.

Using this method the “equivalent units of production” are divided into the cost items/categories. The seed cost per equivalent bushel is  $\$0.33$  ( $\$20 / 60$ ). The operating cost per bushel is  $\$2.00$  ( $\$120 / 60$ ), the overhead costs  $\$1.50$  ( $\$90 / 60$ ), and the total cost is  $\$3.50$  ( $\$210 / 60$ ). The profit to the enterprise is  $\$30.00$  ( $(\$4.00 - \$3.50) \times 60$ ).

The major advantages of this method are that the cost of production can be compared to the price received for the product and that components of the cost of production can be easily calculated. Also, the cost of these components can be compared to the price of the product.

The major disadvantage of this method is that implicit in the calculation is an identity between the joint products. This calculation makes the percent profit (or loss) on each product identical. In other words, if the profit on wheat grain is 10 percent, the profit on wheat straw is 10 percent.<sup>1</sup>

## **Whole Farm, Enterprise or Partial Budget Analysis - *What Approach Should I Use?***

The following three budget methods are often used in the same analysis.

### ***Whole Farm:***

Whole Farm cost of production budgeting is often used to analyze the past performance of a business and to compare that performance to the same business's performance in prior years as well as to other similar business's.

### ***Enterprise:***

In business's producing multiple products such as diversified livestock and cash grain farms, it is sometimes necessary to sort out incomes and expenses associated with each product regardless of the market unit used. When this is done, the sorting can be a process where the

entire farm business is sorted into enterprises – one for each crop and at least one for the livestock enterprise. Many larger farm business managers also breakdown the dairy or livestock enterprise into separate enterprises for the production, young stock and finishing herds respectively.<sup>2</sup>

An enterprise budget can be used to analyze present or estimate future costs and returns associated with the production of a product or products referred to as an enterprise. An enterprise, or profit center, is a distinct part of the farm business that can be analyzed separately. An enterprise is usually based on some production input unit - an acre of land for most crop enterprise budgets, or an individual animal unit for livestock enterprise budgets. Enterprise budgets are an important tool for planning and ongoing farm financial management. Crop and livestock budgets and cost of production figures can be used to estimate profitability, project cash flows, provide a basis for credit, and assist in farm planning.<sup>3</sup>

### ***Partial Budgeting:***

A third option, partial budgeting, is utilized to evaluate the financial impact of a possible change on the projected performance of the enterprise.

## **Conclusions**

Generally, when individuals see a cost of production value, they immediately compare it to the price of the product. Therefore the “Per Unit Sold” method can confuse producers and lead to incorrect decisions because the producer may not understand that the comparison value is “Income per Unit”, not the price of the product. This can lead to bad decisions if a producer is trying to determine a forward contracting or hedging strategy based on their cost of production. The “Residual Claimant” method has limited application because it can only easily calculate the total cost of production.

The “Equivalent Production” method may be best for joint product enterprises. It calculates cost of production figures that can be compared directly to the price. Also components of the cost can be easily calculated and compared.<sup>1</sup>

However, for those who are willing to approach cost of production and profitability from the standpoint of dollars generated by business activities versus the common market price per unit measure, there is the Per Dollar or Percent of Revenue method. Units and value of product production become mute points when incomes and costs are on a Per Dollar or Percent of Revenue basis. With Per Dollar or Percentage of Revenue, it doesn't matter whether the business produces single or joint products. If an enterprise has only one product, the last three methods produce identical results.<sup>1</sup>

Regardless of whether you prefer your cost of production related to the units of product produced/sold or the dollars generated, choose your method based on a clearly articulated purpose for the decision to be made.

## References

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