

Production Record Analysis: Critical Economic Measures for Decision Making in Beef Herds

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Introduction

Continual change and transition are facts of life. World wide political events occur unpredictably and with astonishing speed. Economic indicators reflect increased volatility in the marketplace. Technological advances continue unabated and scientific discoveries give us new understanding about ourselves and our world. We are living in an information age (verging on virtual reality) and the amount of information doubles every eighteen months, last I heard. The information explosion (made possible in part by satellites, computers, etc.) has been contributing to the increase in productivity, and as we near the 21st century, biotechnology is poised to become a powerful force. Experts forecast the following changes in North America in the years to come:

- > increased productivity;
- > fewer farms/ranches and support services
- > consolidated productivity into more concentrated segments
- > an accelerated shift from hand power toward mind power.

Although these trends are having a significant impact on agricultural producers and their support services, agriculture is poised for a new dimension. Opportunity and growth lie ahead for those who will think unconventionally, yet utilize the wisdom of past generations.

Overwhelmed by change and pressed for time, the story of my life, it is tempting to find “quick-fix” solutions to the many issues or problems that we face daily. We may want to make important decisions based on intuition or emotion rather than taking the time to gather the appropriate information/records and carefully analyze the alternatives. Think about it, it is the nature of the world we live in. The media, advertisers, and others often sense the desire for quick and easy answers and respond with simple, direct messages that tell consumers what to do, what to think and what to buy.

It is often not much different in agriculture. I am

always amazed when I attend the trade show at the NCA convention by the amount of resources (labor and capital) that go into marketing and promotion, just for four days. I understand it is necessary in a free market economy to be competitive, but it illustrates the nature of the beast. We demand quality and convenience, and in most cases we are willing to pay for it.

The desire to have easy answers is understandable, but can also be dangerous. Excessive simplification of complex problems often leads to simple “solutions” that can make matters worse. By the same token, micro-management of a business can make “complex” problems more complex than they really are. Business management problems seldom present themselves as neat packages that can be isolated and systematically solved through a series of action steps. After saying this, the fact is most of us were trained to solve problems this way.

Albert Einstein once said “Everything should be made as simple as possible but no simpler.” Given the complexities of our world and beef industry, how do we determine when we are oversimplifying (or overcomplicating) an issue? Which decisions deserve our careful consideration? To what degree do we heed the advice of others and to whom do we listen—i.e. network? How do we go about setting business goals and objectives and obtaining them?

Dr. Odde introduced us to problem solving and “critical thinking.” It has been said that “learning to think critically is one of the most important activities of adult life.” Critical thinking is the process of thinking about one’s thinking, a cautious evaluation of one’s thoughts. It is consciously directing one’s thinking to make it more rational, clear, accurate, and consistent.

So what does any of this have to do with “Production Records Analysis and Critical Economic Measures for Decision Making in Beef Herds?”

Critical thinking in the context of production records and analysis can help us ask relevant questions, weigh evidence offered in support of arguments, interpret complex problems, and make informed decisions. This is especially important when you or your customer

realize that many problems in beef livestock systems do not lend themselves to clear-cut solutions.

But “critical thinking” alone will not guarantee success in the beef industry. Management must be directed by goals and objectives, and even so, this will not guarantee success. Many well intended personal or business goals are never attained. Then what? We have read, listened and attended all the “goal setting” exercises we can stand, and we are “critical thinkers” or least some of us are.

In my tenure at Colorado State University (9 years) I have had the opportunity to work one-on-one with a number of beef livestock operations of all “shapes” and “sizes”, just like most of you. Some of the “best” managed beef operations were the least profitable. Some of the “worst” managed beef operations were the most profitable. The paradigm is obvious here, changing a way of thinking is not quite as easy.

For beef operations that are truly profit motivated, my experience suggests to me that one or a combination of two factors separated profitable producers from, the rest;

- 1) they have a working understanding of the integrated nature of their beef enterprise when establishing goals and making decisions, and/or
- 2) they have a written production and/or business plan to attain stated goals or objectives.

Note that I suggest that one factor is not a necessary condition for the other, but one or both is a necessary condition for a profitable beef business.

Some producers have such a intuitive sense for the integrated nature of their beef livestock system that they keep hardly any hard copy records, and get along just fine. Some producers make every decision based on a well thought business plan with a complete set of production and financial records, and get along fine.

Some less profitable beef cattle operations may have a complete set of records (well documented business) but lack a working understanding of the integrated nature of their beef operation. Many more less profitable beef operations have knowledge of beef production practices and some vaccination records and some records of receipts and expenditures for tax reporting purposes.

The important point here is that it is not necessarily the quantity of information, but rather the quality of the information. The level or complexity of production records and analysis, and critical economic measures for decision making in beef herds is unique to the individual operation and management. That is the bad news. The good news is, although management informational needs may vary between beef operations/system, the process and methods of analysis are fairly constant. In fact, the recent and continued efforts by the Beef Improvement Federation (BIF), the Farm Fi-

nancial Standards Task Force (FFSTF), and the National Cattlemen’s Association Integrated Resource Management Standardized Performance Analysis committee (NCA-IRM-SPA) all support the thesis for high quality, standardized information, however, not necessarily made “easier,” imagine that!

I have had the “opportunity” to have been involved with the development and field testing of SPA for both the beef and sheep industry for the past several years. From early on, many individuals expressed concern about the complexity of the SPA process. Very few would argue about the completeness of the analysis and recommended performance measures, but it would still be nice to have something that was more “user friendly” and easier to understand.

After completing the SPA process on a number of cow-calf operations, of various “shapes” and “sizes,” I would argue that SPA is a relatively simple and complete analysis. I believe I can say this, not because I’m an over-educated economist (although it helps) but because of the “way” I approach the SPA process and other methods of production and financial analysis. I believe that collecting records, completing production and/or financial analysis is often based on a mindset or attitude we have about a “defined” process, like SPA. (This is where your creative thinking would be helpful). Too often we approach the analysis with the attitude of getting it done and getting done “right”—an event. We end up working for the process rather than the process working for us. Like preg-checking 200 overweight heifers in 20 degrees below zero weather, rather than utilizing the analysis process to assess;

- 1) management’s working understanding of the integrated nature of their beef system, and
- 2) completeness of management’s written/documented production and/or business records, plan and stated goals and objectives.

Every SPA analysis I do is completed with a different level of complexity. All are complete, some more complete than others, but that is not my big concern. I am concerned about whether I met or exceeded the informational needs of the individual manager(s). Clearly, the more complete the analysis the better, but trying to complete an analysis process “way above” or “way below” the informational needs of management just because it’s the “right way,” typically provides little benefit.

My intent here today is not to speak about SPA, but rather to stimulate some critical thinking about the way you approach analysis of production and/or financial information in your business or that of a customer. I will try to identify some methods of partial economic analysis (not complete cost accounting analysis) that I find useful in helping me and my customers (producers) understand the integrated nature of their beef produc-

tion system. I will present a couple of well defined “text” book approaches, others are just my way of looking at the numbers, so if nothing has made sense to this point, then welcome to the club.

Financial Reports and Analysis

Before we get into the fun stuff, I thought it would be timely to share with you a few production and financial management concepts or thoughts. I often like to talk about the primary activities of management to include: planning, organizing, directing, and control. The most important and most challenging is control—the process of analyzing, evaluating, and interpreting the production and financial performance of the business. Production and financial analysis and monitoring of a business is very much a management control process. Like most management processes in a business, it takes some time and commitment to make the business analysis process an important part of the management control activity. Is it worth the time and commitment for me or the producer to complete a “control process,” and at what level of complexity?

To answer this question fairly, first consider these questions. Is the manager satisfied with the production and financial performance of the beef enterprise? What is the reproduction and production efficiency of the herd? What are the major expenses in the enterprise and can a better job be done controlling them? What is the unit cost of production for a pound of weaned calf? Is the financial condition of the enterprise in balance with its cash flow? Is the enterprise meeting its profit goals and objectives?

Initially, the information and data requirements for completing production and/or financial analysis may seem overwhelming. This is often due in part to the use of “new” accounting terminology and valuation procedures, and to the simple fact that there are several approaches to evaluating business “profit” and performance. In general, these can be grouped into primary and secondary financial reports (see Figure 1).

Primary financial reports, or whole farm and ranch analysis, include a balance sheet, income statement and statement of cash flow. Secondary financial reports or partial analysis, include; partial budgets, gross margin analysis, breakeven analysis, enterprise budgeting, the cow-calf or stocker enterprise Standardized Performance Analysis (SPA), cash flow budgeting, credit analysis, and “Paul’s cow-calf pseudo-economics.”

The important thing to remember at this point—keep the financial method of analysis in perspective. Profit is the most fundamental measure of business success, yet it is often an inconsistently used term. Terms like net income, operating income, bottom line, revenue, cash income, returns to management and labor, cash profit, and gross margin all add to the terminology con-

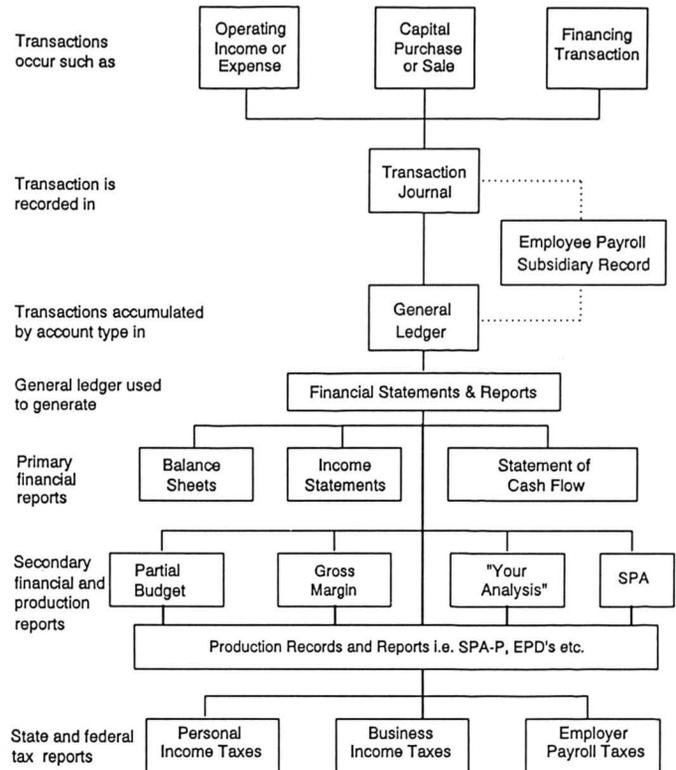


Figure 1. Record System Flow Chart

fusion. It is important to define profit because it is used to send different signals to users of the information.

The definition and calculation of profit (method of analysis) will often influence performance evaluation, technology adoption, and decisions related to investment and repayment capacity. **The most complete measure of profit is the retained earnings or change in equity of the total business or enterprise measured through reconciled balance sheets and accrual adjusted income statements**—i.e. whole farm or ranch analysis.

Whole farm/ranch financial statements (primary reports) provide the manager with the most complete measures of profit and performance for the whole farm/ranch business. These reports should be prepared as accurately as possible and as often as necessary to provide management with important information for monitoring and controlling the business. Furthermore, a set of complete and accurate financial statements provide management with base line data for conducting partial analysis.

Again, what I want to talk about today is partial analysis methods of evaluating production records and critical economic indicators in the beef herd. Two important distinctions that I want you to remember about partial analysis are:

- 1) the term “partial” indicates the change only occurs in one component of the farm or ranch and implies

no major change in the business resource base or overall operational plan, and

- 2) partial ranch analysis will indicate which alternative is better but not which is best.

More often than not, the better alternative is the best. When considering different production and/or financial management alternatives, partial analysis is a very efficient way to evaluate and rank alternatives. The key is to consider the integrated nature of the beef enterprise, and not just the information from the partial analysis. And remember, if you're interested in measuring actual (projected or otherwise) impact of an alternative on profits, whole ranch analysis (primary financial reports) is necessary.

Partial Farm/Ranch Analysis

As we work our way through the following partial analysis methods, there are two questions I want you to keep in mind:

- 1) What information/critical measure is this analysis or process providing me and/or my customer? *and* (maybe more importantly),
- 2) What information is this analysis or process NOT providing me and/or my customer?—i.e. critical thinking in terms of the integrated beef system.

The second question takes a little more time and effort to integrate into your “way of thinking” but often it is as important as the information or critical measure provided by the analysis. Being able to effectively address these two questions is a strong management characteristic of producers/managers who:

- 1) have a working understanding of the integrated nature of their beef enterprise, and/or
- 2) have a written production and/or business plan to attain stated goals or objectives.

The Cow-calf Profit Formula

In the discussion to follow I want to spend a little time discussing a cow-calf producer's profit formula as it relates to the integrated nature of the beef enterprise, and, to help us focus, we will establish a business goal. Obviously there is no single goal that will satisfy every beef producer, however, in general, the following goal should be applicable to the cow-calf segment of the beef industry: **“Manage available resources for maximum continuing net profit (or minimize net losses) while improving and conserving resources.”** Let us consider this goal in the context of the profitability formula for the cow-calf producer, simply stated as:

$$\text{Profit or loss} = \text{Revenue} - \text{Expenses}$$

As I look at the above profit formula, I can't help but think about a manager's chart of accounts. Charts of accounts for most farms and ranches are dynamic and under the best of circumstances must be revised, particularly during the development of the accounting system, or when reporting requirements change. Whatever the detail in the accounting system, remember, for record keeping and accounting purposes, business transactions occur in only one of three categories:

- 1) operating revenue and expenses;
- 2) financing transactions involving borrowing or repayment of debt; and,
- 3) capital asset purchases or sales.

Figure 1 illustrates the flow of business transactions through a record system for the purpose of measuring and monitoring financial performance of the business.

Revenue Accounts

Operating revenue items are derived from the normal operation of the business. In an analysis of the beef enterprise, major items include revenue associated with weaned calves (including raised replacements) and culled breeding stock. Non-ranch revenue accounts should be clearly defined so they can be separated from the business financial analysis.

Expense Accounts

Business operating expenses are both directly and indirectly related to production decisions. Direct expenses are items that are directly related to the production of a certain commodity. Examples of direct expenses are purchased feed, fertilizer, fuel and oil, and veterinary fees.

Indirect expenses (“overhead”) are items that are not directly related to the production of a certain commodity, but are still considered business expense items. Examples of indirect expenses are property tax, utilities, and office supplies.

It is important to keep in mind that a “complete” chart of accounts for each individual producer will depend on business structure, and informational needs of the operation. Remember, detailed records are not necessarily complete, and more often than not, detailed records can be complicated or complex. Electronic record keeping systems make it easy to add complexity—i.e. to many chart of accounts. I believe that there should not be anymore primary expense accounts than there are lines on the Schedule F. Most electronic record keeping systems will allow you to create sub or secondary accounts for the desired detail in records.

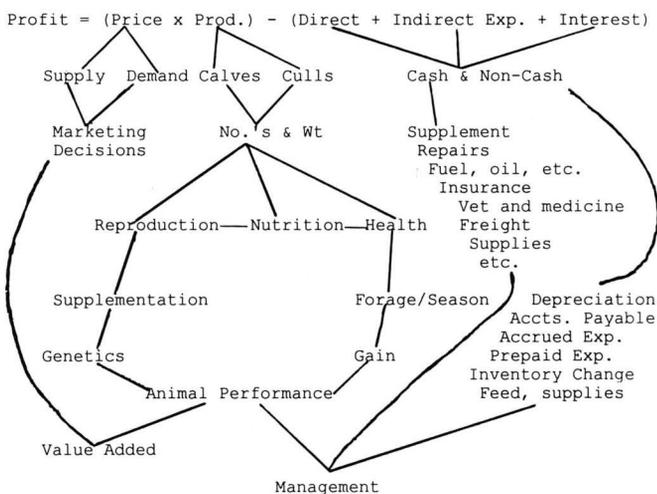
As far as production records go, I believe that all production records should be based, ideally, on a perpetual inventory of livestock; at a minimum, accurate beginning and ending inventory of livestock. Experience with SPA suggests that inventory control (good inventory records) is limited in many beef cattle operations. Consistent year-to-year reproduction and production performance measures are very difficult without accurate inventory information.

At this point I find it useful in working with a manager to do a little "profit mapping" of the above profit formula. (Time to put on your critical thinking cap) Profit mapping is an exercise that helps me and the manager;

- 1) visualize the management's perspective of the integrated nature of the beef enterprise, and
- 2) assess the completeness and complexity of production and financial records.

The important thing to remember here, is that there is no single "profit map." And when working with a manager, you should encourage/facilitate him or her (or both) in the drawing of their own. The idea here is to stimulate some critical thinking about production information and critical economic measures for decision making in the beef enterprise.

Consider the profit map below as an example. This is an example that came to me as I prepared this paper. There is nothing special about it and in fact many of you might want to argue about the technical accuracy. But as a manager of a cow-calf enterprise, this is how I see the system. And until you see what I see, you will have to depend on high pressure and hard sales approaches to change my mind. Well, maybe it's not that difficult, but all of you know what I'm talking about. We all have worked with that "hard to crack" customer. I would encourage you to approach this exercise from your own perspective, but with the manager's profit map in mind.



Consider price in the above profit map. Marketing and pricing strategies can be used to effect the relative level of price, but in a commodity market, the forces of supply and demand determine the absolute level of price. In fact, the beef industry is currently experiencing a little supply and demand adjustment.

However, production for the most part, is independent of the forces of supply and demand. In a simple context, beef production is a function of numbers and weights, which provides some measure of animal performance. However, as we look more closely at animal performance, we see that this is a function of nutrition, reproduction, and health (as influenced by supplementation, forage quality, genetics and gain) which are all influenced by management and management decisions.

Many of the decisions that directly and indirectly affect the cost of production are a function of management - decisions that effect the allocation of resources in a unique production environment. Profit mapping can help you determine if you are working with a cattle breeder, cattle producer, forage producer, or some combination.

Well enough small talk, let's look at a numerical example of the profit formula above, where;

$$\text{Profit or loss} = [((\% \text{calf crop} \times \text{weaning wt}) \times \text{price}) + ((\% \text{cull lvstk. sales} \times \text{wt}) \times \text{price})] - \text{expenses/cow}$$

For example, assume we have an 85% weaned calf crop (CC), as a percent of cows exposed to breeding, 500-lb average (WW), and a \$.85/lb average price (PCC). Cull livestock, cows and bulls were 14% (CL), as a percent of total breeding livestock, 1150-lb average wt. (CW), and a \$.42/lb average price (PCL). Total annual expenses were \$350 per cow (ACE). Lets plug some numbers into the profit worksheet below.

Cow-calf Profit Worksheet

Example AABP Producer 1:

$$\begin{aligned} \text{Profit or Loss} &= [((\% \text{CC } 85\% \times \text{WW } 500\text{lbs}) \times \text{PCC } \$.85/\text{lb}) + ((\text{CL } 14\% \times \text{CW } 1150\text{lbs}) \times \text{PCL } \$.42/\text{lb})] - \text{ACE } \$350 \\ &= ((425\text{lbs} \times \$.85/\text{lb}) + (161\text{lbs} \times \$.42)) - \$350 \\ &= (\$361.25 + \$67.62) - \$350 \\ &= \$428.87 - \$350 \\ &= \$78.87 \end{aligned}$$

The above profit worksheet provides a partial analysis of profit for our cow-calf enterprise example and is not intended to be a Generally Accepted Accounting Principals (GAAP) financial report. However, the cow-calf worksheet can provide some valuable insight

for evaluating production records. Consider what the profit worksheet example is telling us. The first thing we can note is that all values are converted to a common unit of measure, value per cow. This is important for establishing and monitoring production and financial goals and objectives and ranking alternatives.

For example, our average weaning weight was 500 lbs per calf. But when we consider % calf crop, 425 lbs per cow were weaned for a average value of \$361.25 per cow. That represents a 75 lb difference, or \$63.75 (\$.85 x 75 lbs), between average weaning weight per calf and production per cow. Is this acceptable? If not how should I redirect resources and management to attain a desired goal. Obviously, this is a indicator of reproductive performance or lack there of, and clearly there could be a trade off between increased % calf crop (reproductive efficiency) and additional cost. But would another 2 % weaned calf crop be worth? In pounds of production per cow, 10 lbs (2 % x 500 lbs), and in value of production, \$8.50 per cow (\$.85 x 10 lbs). That just about covers the vet bill.

The national SPA data summary comes in with an 84 % average calf crop weaning percentage. From an economic standpoint, I generally would not want to see average weaning percentage below 86 % year after year, in general. Obviously this depends on each production/management situation. Some will be profitable at a lower percentage, some will require a higher rate of production.

For example, let's assume we have another producer with very similar production numbers to the above example, except his/her CC is only 80%, but his/her ACE is \$300 per cow. Plugging these numbers into the profit worksheet we get the following results;

Example AABP Producer 2:

$$\begin{aligned}
 \text{Profit or Loss} &= [((\%CC \text{ 80\%} \times WW \text{ 500lbs}) \times PCC \\
 &\quad \text{\$.85/lb}) ((CL \text{ 14\%} \times CW \text{ 1150lbs}) \times \\
 &\quad \text{PCL \$.42/lb})] - ACE \text{ \$300} \\
 &= ((400\text{lbs} \times \$.85/\text{lb}) + (161\text{lbs} \times \$.42)) - \\
 &\quad \$300 \\
 &= (\$340 + \$67.62) - \$300 \\
 &= \$407.62 - \$300 \\
 &= \$107.62
 \end{aligned}$$

Well, obviously we have a little calculation problem because the “worst” producer is more profitable than the “better” producer, by a difference of \$28.75 per cow. If AABP Producer 1 ACE were \$300 per cow, their net profit would be closer to \$128.87 per cow (\$428.87 - \$300). The \$50 question is, how do we cut or increase production? By critical thinking about the integrated nature of the beef enterprise under consideration.

Our profit worksheet example of AABP producer 1 also tells us that we produced a 161 lbs of cull livestock

sales per cow for a average value of \$67.62 per cow or 16% of total revenues. Clearly cull livestock sales are important and are also a function of the reproductive efficiency or turnover of the cow herd. The level of culling will vary from year to year in most cow herds. Sustained high levels of culling (16% +) tend to put a strain on cash flows as replacement livestock are retained and developed and/or purchased to maintain herd size.

Mention of replacement heifers brings me to another observation I want to make about the Cow-calf Profit Worksheet example. Most of us, including my wife, are most concerned about CASH FLOW. In our example, the “net profit” was \$78.87 per cow. Not bad. However, this does not necessarily represent “net cash flow.” If we raise our own replacements in our example, then this is revenue that will not show up as cash flow. In our example, if we retain replacement heifers at a rate of 15%, as a percent of exposed cows, this would reduce actual pounds of weaned calf marketed per cow from 425lbs to 350lbs (15% x 500lbs = 75lbs) or \$297.50 of marketed weaned calf production per cow. The net cash flow effect would be \$15.12 cash receipts per cow. If we have 50 cows in our example herd, we would have a \$756 “cash profit” to report to Uncle Sam. If we were talking 500 cows, this would mean a \$7,560 net profit.

Or is it? What about the expense side of the profit formula? You should be wondering if the \$350 annual cow cost includes; direct and indirect, cash and non-cash expenses. Yes to all of the above. In fact it includes \$50 non-cash expenses.

As a rule of thumb for determining a “ball park” figure for what annual cow cash costs should be, take 65% of estimated cash receipts (including cull livestock) generated per cow. In our example, AABP producer 1 had \$365.12 in cash receipts (\$297.50 calves + \$67.62 culls), thus the cash cost should ideally be around \$237.33 per cow (.65 x \$365.12). The remaining 35% of cash receipts (\$127.79 per cow) can then be used to pay debts, replace capital assets, family living and retained earnings. If the AABP producer could increase cash receipts to \$475 per cow then a annual cow cash cost of \$308.75 would work.

My point to all the above, cow-calf analysts and producers must know and understand those factors that influence the level of production, the value of production, and the cost of production in their beef operation. The Cow-calf profit worksheet provides a simple format for assessing profit. Take some time and work through several profit worksheet examples. I think you'll start to see that if maximizing profit (or minimizing losses) is a goal, management decisions must be implemented to increase production (% calf crop and weaning weights) while decreasing costs. Realistically, producers will achieve an optimum combination of both.

Partial Budgeting Analysis

A partial budget (also known as a partial profit budget) is the tabulation of expected gains and losses due to relatively minor changes in the beef enterprise (i.e., leasing versus purchasing equipment, employing an alternative marketing method, comprehensive health program, pregnancy testing, etc). It is a method of evaluating and examining the total gains (benefits) and losses (costs) that result if a change is made in a part of the business or enterprise.

Partial budget analysis is simple to use and provides information about changes in costs and benefits caused by following a given practice. It requires minimal information about changes in direct operating expenses and revenues. However, production and price information must clearly reflect farm or ranch conditions. The general tendency is to overestimate benefits and underestimate costs. This is where profit mapping can be helpful.

Since partial budget analysis is relevant only for component technology or management, it is not suitable for answering questions in which several factors determine the contribution of an alternative technology or management practice. In the case of the beef enterprise, the effect of the alternative technology or management practice on beef production should be estimated carefully. Erroneous production coefficients may result in misleading conclusions.

Performing Partial Budget Analysis

A good start to any production/financial analysis of new or alternative technologies or management practices is to clearly define business objectives, especially as they relate to a given enterprise. Determining the manager's goal, as it relates to the business plan is a good place to begin.

The second step is a detailed description of the change (i.e., new or alternative management practice or technology proposed). Based on this description, it must be determined which factors will remain the same and which factors are expected to change. After these factors are identified, they are tabulated as either gains or losses.

Gains or losses should be subdivided into two categories. The gains will include added returns (any additional revenue that is expected) and reduced expenses (any expenses that are saved). The losses include any added expenses (additional expenses) and reduced revenue (foregone revenues). The difference between gains and losses is the net benefit or loss resulting from the change under consideration. In simpler terms:

$$\frac{(Added\ Returns + Reduced\ Costs) - (Added\ Costs + Reduced\ Returns)}{=} = Gain\ or\ Loss.$$

The above equation may be set into a form that allows detailed itemization as follows:

Gains (A)	Losses (B)
Added Revenue	Added Expenses
Reduced Expenses	Reduced Revenue
Total A	Total B

$$Difference\ (A - B) = Gain\ or\ Loss$$

The following example shows how this format can be used to evaluate a health management program for our AABP producer 1 example. Assume that a veterinarian has recommended to a producer a supervised, comprehensive, year round herd health management program. The producer's goal is to improve the overall productivity and profitability of the 500-head cow herd. Currently, the enterprise's calving percentage is 89 percent, weaning 85 percent calf crop with 500 pound calves. Cow death loss is 1.5 percent. The following data supporting the benefits and cost of the recommended cow herd health program is provided by the veterinarian.

Gain-loss components	Quantity	Price	Value
Additional Weaned Calves (3 pct. or 15 lbs per cow)	7500 lbs	\$.85	\$6,375
Additional Weaning Weights (20 lbs per calve weaned)	8800 lbs	\$.85	\$7,480
Additional Labor	500 cows	\$ 5.00	\$2,500
Additional Vet Supplies	500 cows	\$ 5.00	\$2,500
Additional Vet Services	500 cows	\$12.00	\$6,000
Reduced Vet Supplies	500 cows	\$ 2.00	\$1,000

The following partial budget shows the gains and losses associated with the recommended herd health program.

Gains (A)		Losses (B)	
Added Returns:		Added Costs:	
Weaned Calves	\$ 6,375	Labor	\$ 2,500
Weaning Weights	\$ 7,480	Vet Supplies	\$ 2,500
Subtotal	\$13,855	Vet Services	\$ 6,000
		Subtotal	\$11,000
Reduced Costs		Reduced Returns	0
Vet Supplies	\$ 1,000		
Total A	\$14,855	Total B	\$11,000

Difference (A - B) = \$3,855 gain

The above partial budget analysis of the AABP beef enterprise indicates that the enterprise would benefit from an improved health program by \$3,855 or \$7.71 per cow. An additional \$7.71 of revenue per cow does not seem much, but clearly the partial budget analysis process helps put the benefits and costs of an alterna-

tive management practice in perspective. Remember, the general tendency is to overestimate benefits and underestimate costs.

A last step in partial-budget analysis is obtaining a list of all important non-cash considerations that are relevant to the proposed technology or management practice. For example, if the change in input requirement is large, a special note on cash flow should be added. Examples are changes involving business inputs that are not always available, such as technology involving high-management skills, or a technology involving expensive capital equipment.

Although a partial budget is easy to interpret, it is rarely presented with a statement of management objectives (resource base, and important non-cash considerations). Therefore, care should be taken in the interpretation of partial budgets. A first consideration should be whether the best profit criteria have been used. Because of the linear nature of partial budgeting, evaluation of technologies using partial budgeting or gross margin measures per cow implies it is in the management's interest to maximize benefits to the land, often this is not the case.

Partial budget analysis has several advantages. Primarily it is simple. It can be performed with a hand calculator, or pencil and paper. Partial budget analysis requires less data than a complete set of financial statements since aspects of the operation that remain constant are not examined. Nearly any other form of financial analysis involves collecting at least the same information as one needs for conducting a partial budget analysis. In many cases, final conclusions about the adaptability of an alternative technology or management practices can be drawn after only a partial analysis.

The greatest danger of using partial budgeting is neglecting the limited resources of the business. Technologies or management practices are often analyzed without the manager realizing the effect on the farm or ranch resource base. There are two reasons why this mistake is made. First, nearly all new or alternative technologies or management practices involve an increase in purchased inputs by producers. Availability of cash, however, is a real constraint for many businesses.

Gross-Margin Analysis

Gross margin is the difference between the gross revenue of a business activity and its total direct operating expenses; that is, it is the estimate of returns above direct costs for a given business, business enterprise or activity. Total gross margin for a business is the sum of the gross margins of all of the business activities. Gross margins are usually expressed in units of some common resource; for example, gross margin per cow is used to measure the efficiency of cow/calf-production activities.

Gross margin analysis is similar to partial budget analysis in many ways. It is calculated as total gains over direct costs or expenses. Direct costs, as previously defined, are the expenses that vary directly because of the technology or management practices applied, e.g., feed costs, medicines, transportation costs, equipment repair, etc. Total gains generally are the total values of the animal products. The beef SPA financial statement format computes the gross margin for the whole cow calf enterprise.

Example: Colorado Ranch Management School

The ranch manager would measure the ranch production by showing the sales for the year and what animals the ranch had left at the end of the year. From this **gross income**, he would have to deduct the animals he started with plus any that he purchased during the year. In each case he would not only account for the number, but also for the dollar value. Each class of livestock (cow, heifer, bull, ewe, ram, etc.) are assigned a conservative value that the ranch could reasonably expect to receive for them, any time during the year. Then, by multiplying the numbers in each class by the value assigned, you can put a conservative dollar value on the beginning and ending inventory of livestock.

Example:

SALES		
20 cull cows	\$ 6,000	
bulls	0	
calves	0	
	0	
TOTAL SALES		\$ 6,000
CLOSING INVENTORY		
76 cows @ \$400	= \$30,000	
4 bulls @ \$800	= 3,200	
80 calves @ \$250	= \$20,000	
	\$43,200	
TOTAL CLOSING VALUE		\$53,600
GROSS INCOME		\$59,600
Less:		
Opening Inventory		
100 cows @ \$400	= \$40,000	
4 bulls @ \$800	= 3,200	
	\$43,200	
Total Opening Value		\$43,200
Purchases		0
COST OF SALES		\$43,200
GROSS PRODUCT		\$16,400

Note, the same values per head were used for both the opening and closing inventory. This avoids the problem of paper profits and losses. What this formula has told us is that if the herd was sold today, the ranch would receive \$53,600. Add to this figure the \$6,000 already

received and the ranch total production for the year would be \$59,600. But since the herd could have been sold at the beginning of the year for \$43,200 - using the same conservative values - the real increase in value was \$16,400.

It's very much like the tally you keep on your cows. You know how many you had at the beginning of the year, how many you sold and how many you bought. At the end of the year you count them again and reconcile your tally. But when we do a *trading account*, which is what this formula is called, we put a dollar value to the numbers. We then end up with a *gross product*, expressed in dollars, for the entire herd or enterprise.

The next step is to subtract the Direct Cost discussed in Chapter One from the enterprise gross product to arrive at the enterprise's *gross margin*.

Example:

GROSS PRODUCT		\$16,400
Less Direct Cost:		
Supplement, salt, mineral	\$4,000	
Vet and medicine	1,000	
Freight	0	
Interest @ 10%	<u>4,840</u>	
TOTAL DIRECT COST		<u>9,840</u>
GROSS MARGIN (gross product less direct cost)		\$ 6,560

The gross margin is the cow/calf enterprise's contribution to cover the rest of the ranch's overhead cost. Note that, had the calves brought \$300 instead of \$250, the cow/calf enterprise would have made \$4,000 more. So you can see that gross margin is affected by gross product and it, in turn, is affected by price and production.

In using gross-margin analysis, it is tempting to conclude that business profit can always be increased by expanding the enterprises that have high gross margins per unit at the expense of those that have lower returns. This may not be true because of resource and other constraints. If the number of animals with high per-unit gross margin is increased without regard to management and/or resource constraints, indirect expenses or "overhead costs" will probably increase, perhaps to the point that the increase in total gross margin is more than the offset.

One of the advantages of this method is that gross-margin analysis can be easily used in the ranking of more than one technology or management practice. It lends itself to the analysis of the results of different alternatives in a given enterprise. By comparing the gross margin for each alternative, the most promising alternative can be selected, i.e., the alternative with the highest gross margin. When combined with break-even analysis, conclusions can be drawn about the significance of differences between alternatives. Alternatives

can be ranked and managers may focus further analysis on the most "profitable" alternative.

Break-even Analysis

Break-even analysis (also called unit cost of production analysis) determines the level at which the gains and losses are equal. This level of values (cost) and quantities is known as the **break-even point**. Above the break-even point, costs will be higher than revenues and the use of the technology or management practice becomes financially or economically unfeasible. Generally, break-even analysis is done by manipulating the most uncertain key factors.

Break-even analysis is used to trace the effect of a change in assumptions. If a relatively small change in weaning weights of a given management practice results in a zero balance between added benefits and losses, this management practice can be considered nearly equal in profitability. The choice of management practices in that case is rather irrelevant, and it is very likely that management will maintain the existing operation.

Break-even analysis can also be used to compare gross margins or other partial analysis. Break-even analysis can be used to measure how sensitive the results of the partial analysis are to changes in some of the critical assumptions, i.e., prices, weights, weaning percent, etc.

Break-even analysis offers two types of information: break-even price and break-even output. **Break-even price** is the price (unit cost) at which an enterprise's given level of production, if sold, would enable the business to at least cover costs. **Break-even output** is the level of production that would enable the business to recover costs if the products were sold at the given or prevailing price:

$$\text{Break-even price} = \text{cost of production} / \text{level of production}$$

$$\text{Break-even output} = \text{cost of production} / \text{prevailing price}$$

As break-even analysis is a variation of gross-margin or partial budget analysis, the same set of data is required. However, for the break-even analysis, the manager should try to obtain historical data on the variability of prices and/or production. As in previous partial analysis, you must understand what the analysis is telling you or your customer.

Example: AABP Producer 1

$$\begin{aligned} \text{Break-even enterprise price} &= \text{ACE} / (\text{calf prod} + \text{cull prod.}) \\ &= \$350 \text{ ACE} / (425\text{lbs} + 161 \text{ lbs}) \\ &= \$59.72/\text{lb} \end{aligned}$$

What does this value tell you? That on average, producer 1 needs \$59.72 per cwt for all products sold to

cover the \$350 cow cost. This does not tell me what the unit cost of production is for weaned calves. To determine the unit cost of production for weaned calves we have to subtract non-calf revenue (cull cow and bull sales) from the annual cow. Remember, cow herds produce calves and cull. Now our unit cost of weaned calf production would look like;

$$\begin{aligned} \text{Weaned calf unit cost of prod.} &= (\text{ACE-cull sales})/\text{calf prod.} \\ &= (\$350 - \$67.62) / 425\text{lbs} \\ &= \$282.38/425\text{lbs} \\ &= \$66.44 \end{aligned}$$

The unit cost of production for a pound of weaned calf in our example is \$66.44 per cwt. An important number in this calculation is the non-calf revenue adjusted cost figure—i.e. \$282.38 in our example. This is the cost per cow for each weaned calf produced in the herd. To determine the cost per weaned calf, divide the non-calf revenue adjusted cost figure by the weaned calf crop percentage, CC—i.e. $\$282.38 / 85\% = \332.21 cost per head, weaned calf. This is a good figure to have when valuing replacement animals.

Break-even analysis in association with partial budget or gross margin analysis can be used as a measure of risk. The analysis will yield the minimum or maximum value of a critical factor at which an alternative technology or management practice is expected to become or stop being beneficial to the rancher.

One of the advantages of break-even analysis is that instead of calculating a fixed value, the results of a budget analysis can be assessed in terms of probabilities. In other words, an estimate is made of the probability that an actual value will be above or below the established break-even level. Thus one can assess the possibility of the proposed change being profitable, assuming all other budget components can be fairly well predicted. In addition, it is usually easier to assess the probability of an uncertain coefficient exceeding or falling below a specified value than it is to assess an expected value for that coefficient. If the break-even value is very high or very low, conclusions can be made about the profitability of the change with a high degree of confidence.

Limitations of Partial Analysis

Typically we're concerned about critical economic measures to begin with to evaluate management alternatives and/or technologies. Intensive management or technologies are promoted that generally require higher labor/management input per cow unit. It is often wrongly assumed that labor and/or management is readily available, or can be diverted from other enter-

prises or tasks to the business enterprise or component under consideration.

A third disadvantage of partial analysis is the lack of the understanding of management objectives. It is well understood that managers behave rationally. However, this does not necessarily mean that they are concerned with maximizing returns of one given enterprise. For example, it may be possible to demonstrate that an increase in benefits could result from a comprehensive herd health management program. However, management, financial, and/or labor constraints may limit the ability of the business to fully implement such a program. The key point is that the partial view of the production system might obscure other aspects which directly or indirectly affect the overall business.

A fourth limitation is the lack of time analysis. During the process of tabulation, all factors are arranged as occurring during the same time period. Timeliness of activities, however, is the important aspect. In order to realize how adoption of an alternative technology or management practice affect other business operations, it is important to know if labor required will occur during one peak period such as one week or be spread out over a longer time frame such as three months. Similarly, the time for various management activities is limited.

It is necessary to know at what time and for what duration resources are required. By the same token, the problem of cash flow tends to be overlooked. The longer the time period between investments and returns, the less likely the manager would be attracted to an alternative technology or management practice.

And finally, it is important to remember although partial budget analysis gives an indication of what is "better," it does not indicate what is the "best." Partial budget analysis is most useful:

- 1) where a single component must be analyzed (i.e., a feed supplement forage for medication),
- 2) where inputs and outputs are measurable and easy to price,
- 3) where animals' yields vary little between operations,
- 4) where profitability is the major concern rather than the issues such as equity and income distribution, and
- 5) where fixed costs do not change.

The merit of partial budgets lies more in the tabulation of the factors that would be affected by the technology or management practice, rather than the value (prices) attached to these factors.