

SELECCIONES

Critical Control Points of Cost Containment

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Evaluating production on the farm

Evaluation of a farm production system is necessary in the following cases: 1) the owner desires to sell the farm, 2) potential investors are considering purchasing the farm, 3) the farm is in financial trouble and needs to determine the source of the shortfall, 4) the farm is expanding and needs the information for loans and to determine the best way to expand, and 5) the producer wants to improve productive performance.

Evaluation of a farm production system requires the ability to observe and assess a number of interrelated factors simultaneously. The three questions that must be considered are 1) What are the main limiting factors on this specific farm?, 2) Where are the biggest potential impacts made in this system?, and 3) What are the best answers, both short-term and long-term, for this individual farm?

Evaluation of the production system includes comparisons to some standard, as well as to the farm's internal goals. In most cases it is necessary to ask if the goals are appropriate. An outdoor breeding herd with a farrowing rate goal of 92% may need adjustment. A farm with capacity to finish 5,000 pigs with a goal of 6,000 may have problems. Once the goals and standards for comparison are established, then evaluation of production can take place.

We begin the evaluation by collecting baseline data on the farm. The first consideration in the evaluation is the endpoint – how many pigs are produced on an annual basis? At typical levels of production, throughput is more important than most measures of efficiency. Once throughput is established, measures of

efficiency become more important and are evaluated. The following list gives some thumb rule indicators of herd performance based on experience and the performance levels reported from various databases. Farms that perform at these levels are usually successful. The two parameters that overshadow all others in importance on most farms are throughput (total annual sales), and feed cost per pound of gain. Evaluations of farm productivity should start with these two parameters.

Thumb-rules of efficiency

The list given here provides "Thumb-rule" indicators of herd performance, and is used in the initial assessment of a hog farm. These items are not necessarily the final goal for the farm, simply a "reading on the dipstick" which is above the "add" level and most often below the "full" indicator. These thumb-rules are used to get a ballpark estimate of how well the farm is producing.

1. **Annual total sales** – should approach or exceed 20 times the average sow inventory.
2. **Litters/sow/year** – should be close to 2 for pen-mated and pen gestated sow herds, >2.3 for confinement, hand-mated/artificially inseminated, individually-housed sow herds.
3. **Pigs weaned/sow/year** – has to be 21 or more to sell 20
4. **Farrowing rate** – target > 80%. It is never as high as people without records think it is. Producers with outdoor and pen mating

systems usually over-estimate farrowing rate, and don't account for first service performance.

5. **Days to market** – databases show average to be around 200 days and decreasing. Many “close-out” systems show days to market from 170 - 180. These closeouts account only for those animals which go to market at the first close-out. Producers without good records usually underestimate days to market because they do not account for “tail-enders” that pull the average up drastically. It is difficult to accurately account for days to market in continuous flow production systems. Conversion to AIAO will improve accuracy of producer estimates, but is still not as accurate as a detailed record system.
6. **Nonproductive Sow Days (NPD)** – NPDs are any days a sow is not either lactating or gestating. PigCHAMP data shows that the best herds can achieve 30 to 35 days; good herds 40 to 45 days; average herds are in the range of 70 days; and many herds are over 70 days.
7. **Feed cost per pound of gain** – The Swine Graphics database shows some producers at \$.19, the average at \$.21, and the target at \$.20 (1991 data).
8. **Feed efficiency** – ≤ 3.1 for inside finishing (50 to 250 lb.), ≤ 3.5 for outside finishing (3.8 is typical). Nursery FE for single-site farms should be < 2.0 . For SEW nurseries should be around 1.5.
9. **Mortality figures** –
 - a. breeding herd $< 4\%$ in confinement, $< 8\%$ outside. Sow mortality in outside herds and in many confinement herds is higher than we think.
 - b. preweaning – ballpark figure = 10%. Average is around 14%.
 - c. nursery – $< 2\%$; grow-finish $< 3\%$; less than 2% tail-enders” in confinement production; $< 5\%$ in outside production.
10. **Feed consumption** – The challenge in grow-finish is to increase feed consumption and minimize feed waste. Measuring disappearance is the best we can do on most farms. Feed “consumption” should average 4.5 lb./day or more from weaning to market for reasonable

growth performance. Many nursery/grow/finish diseases (especially respiratory diseases) exert their worst effects on performance by decreasing appetite and thus growth.

11. **Health products and feed additive costs** – are excessive on many farms. A target of $< \$3.50$ per pig for all health related products (vaccines, injectables, and feed additives). Feed additives in most cases should be $< \$1.50$ to $\$2.00$ of the total per pig marketed.

Cost of production related to efficiency

High productivity/low variance production systems

Developing a high productivity/low variance production system involves coordinating all the facets of production and enabling them to reach their potential in a synergistic fashion so that overall production is consistently optimized. The production areas that must be coordinated to produce a high output/low variance outcome are 1) throughput, 2) the health assurance program, 3) the genetics/breeding program, 4) the facilities and buildings, and 5) the nutrition technology employed. Details on each of these areas are now addressed:

Throughput

Throughput is primarily a manufacturing term and refers to the amount of finished product generated by a production process in a given period of time. On-farm, throughput refers to volume of production appropriate for the fixed assets that are in place. The first consideration is sow inventory relative to the number of gestation and farrowing spaces that are planned or available. Secondly, mating targets must be established and achieved for each breeding group. Historical records that establish a track record for each month throughout the year are required to establish seasonal targets.

The record-keeping system also needs to be able to project farrowing rates and gilt needs 4 months in advance. The farrowing rate report should account for sows that have fallen out of the breeding groups on a weekly to bi-weekly basis, depending on the frequency of data entry. Historical trends are important here as well, as

farms that have a history of pregnancy loss late in gestation will need to account for those when placing gilt orders. Gilt pool numbers and management are ultimately the major consideration in assuring high throughput. Mating targets cannot be reached unless the required numbers of gilts is available for each breeding group. There must be adequate space for the number of gilts required during each season of the year. During the summer months, it may be necessary to house twice as many gilts as during other seasons of the year. Gilts must be managed such that a predictable number are available for breeding in each group. This includes proper feeding and boar exposure at the appropriate times.

Genetics/breeding program

The pig genotype that is used must allow the production system to meet its production and financial goals, and allow the system to produce in a high throughput/low variance manner. The selected genotype must be able to meet the system's goals for reproductive performance, growth, and carcass quality. The genetic source should be able to supply the required numbers of animals in a timely manner, ideally from only one source herd. The genetic source should provide the purchaser with evidence of its commitment to research, development, and long-term genetic improvement. Assurance that the product is going to be available on a long-term basis, but with improvements, is needed. Carcass lean of 50 - 52% is now about average in today's market, but evidence should be available that improvement to 54%+ in the next few years will be occurring. Available breeding systems include rotational crosses, rota-terminal crosses, internal grandparent programs to allow terminal crosses for the market pigs, and terminal cross programs in which all gilts are purchased. Breeding management programs include pen-mating, hand-mating, or the use of artificial insemination (AI). Breeding systems and breeding management programs must allow the system to meet throughput targets and carcass quality targets. Some type of terminal program with hand-mating or AI are the only options for high throughput/low variance systems. AI can allow producers to take advantage of faster genetic improvement and better quality boars. AI has more potential for reducing variation than any other technology available today. Because

fewer boars can be used over the same number of sows, variation should be reduced.

A routine pregnancy monitoring program, including 21- and 42-day heat checks, 30- and 50-day ultrasound checks, and 65- and 90-day visual appraisals should be conducted. Vigilant detection of open sows at the earliest possible time will not only assist in reducing nonproductive days, but will also help reduce variation in the number of sows farrowed. Finally, the housing system should be consistent with the chosen genotype and the production targets, allowing high productivity and low variance. Although other systems may be able to fulfill these requirements, individual gestation stalls are the housing system that give the highest productivity and lowest variance in the hands of most managers.

Since reproductive performance is so important to "in-control" production throughout the rest of the production process, it is important to understand how to interpret and use the major reproductive measures listed below.

Interpreting specific reproductive parameters:

1. *Wean-to-Service Interval (WSI)* – is an often overlooked indicator of reproductive performance. Percent sows bred by 7 days gives some idea of the variation involved in WSI. Normally, the average WSI should be 5 - 6 days and the percent bred by 7 days should be 90%.
2. *Entry to First Service Interval (EFSI)* – can be deceptive. Many herds enter gilts into the record system on the day they are mated, therefore EFSI is low. In order to accurately assess and control the gilt pool, however, gilts should be entered into the herd the day they would have otherwise been marketed, or in the case of purchased gilts, the day they enter the farm.
3. *Pigs born alive per litter* – biologically is a function of total born minus stillbirths and mummies. In practice, it depends on the ability of the person recording the data to distinguish between live-born and stillborn pigs. It is not unusual to see the proportion of live-barns vs. preweaning mortality change with a change in farrowing house personnel.

4. *Farrowing Rate (FR)* – is an over-rated measure of reproductive performance. It is essential to know FR in order to set targets, however, litters/sow/year and nonproductive days are better measures of reproductive efficiency.
5. *Litters per Sow per Year (LSY)* – This figure is determined primarily by the lactation length that has been determined for the farm, and the ability to find recycle and open sows early in gestation. Herds with hand-mated, individually housed sows and lactations around 21 days should accomplish > 2.3. Many sows go through their lifetimes averaging 2.5 litters per year. A relatively small proportion of sows keep most herd averages down.
6. *Nonproductive Days (NPDs)* – As with LSY, a small proportion of sows often contribute a high proportion of total NPDS. NPDs are influenced by the conventions used for gilt entry and sow culling. Some herds remove sows from the breeding herd the day the culling decision is made, others wait until the sow actually physically leaves the herd.
7. *Pigs Weaned per Lifetime Female (PWLF)* – is a good combined measure of sow productivity and sow longevity. A herd that weans 9.5 pigs and averages 4 parities per female should have 38 PWLF.
8. *Sow inventory* – may fluctuate as efficiency changes, but must be kept at a level that will allow meeting mating targets. In most herds it should increase during the summer months.
9. *Pigs weaned per sow per year* – A good measure for assessing the reproductive efficiency of the sow, and if inventories are kept in line, gives a reasonable estimate of facility use. It is a function of pigs weaned per litter and litters per sow per year, with LSY having a greater impact in almost all herds.

Health assurance program

The health assurance program is of primary importance in promoting high productivity/low variance production. Once sow inventory, mating targets, and mating management are

being properly managed, diseases, both primary and secondary, become significant contributors to variation in performance. The health assurance program should address both external and internal biosecurity. It should minimize the opportunity for diseases to enter the herd for the first time (external biosecurity), as well as minimizing the effects of diseases within the herd (internal biosecurity).

New breeding animals should be obtained from one source whose existing health status is compatible with the receiving herd. If a start-up is being planned, the source-herd health status should be evaluated critically for the presence of diseases that are of particular concern in start-up herds: (parvovirus, streptococcal and staphylococcal organism, and PRRS). By working closely with the source-herd veterinarian, "rocky" start-ups won't be avoided entirely, but in many cases they can be smoothed out. The source herd should be negative for all diseases of regulatory concern. Suppliers should be willing to provide the results of any regular herd surveillance programs, including clinical observations, serological screenings, and slaughter checks. Communications between source-herd and recipient-herd veterinarians should be conducted as needed.

A high productivity/low variance production system will use an appropriate isolation and quarantine protocol for new breeding animals, worked out in conjunction with their consulting veterinarian. The plan will include some type of isolation facility located at least 200 feet from the main farm in the case of a mechanically-ventilated building, and at least 200 yards from the farm in the case of a naturally-ventilated building. The external biosecurity plan will include an external barrier such as a fence, so that wandering people and animals are discouraged. Visitor policies will be rigidly enforced, possibly including a set number of "pig-free" days. A shower-in, including a change of clothes into those provided by the farm, will be a part of the biosecurity plan. Load-in and load-out procedures that minimize the potential for pigs re-entering the loading chute or building after entering the truck are necessary. Delivery areas for feed ingredients or complete feeds should be provided so that delivery personnel do not need to enter the farm. The biosecurity program of the feed supplier, and the manner in which they handle feed ingredients, and their quality assurance program should be investigated and understood as well.

Internal biosecurity, or the prevention of the spread of disease organisms within the herd, is critical to a high throughput/low variance system. All-in, all-out production should be practiced by room as minimum, preferably by building, and by site if the production system is large enough. Each production area must be cleaned, disinfected, and allowed to dry before a new group of pigs is brought in. Finally, the farm personnel should be certified at level III of the NPPC Pork Quality Assurance Program and the farm should be using an independent health consultant on a regular basis.

Facilities/building types

Pigs are resilient creatures and can be produced in a variety of facilities and building types. High productivity/low variance production, however, requires some standardization of building types within a system. Standard systems today may be either mechanically- or naturally-ventilated. Manure may be handled by flushing under slats or wire, by a pit recharge system, or by a hairpin gutter. Stocking density and space allowances per pig should be within normally accepted ranges within the industry and should allow for pig performance that is consistent with projections and industry standards. In any production system, "tail-ender" pigs are inevitable, and provisions must be made for accommodating them. They must not be allowed to violate the integrity of age-segregated groups.

Ideally, the separation of the various phases of production onto different sites can be accomplished. Although our research has shown that there is no advantage to removing pigs from a high-health sow herd, separate-site production allows for the specialization of labor, it encourages all-in, all-out production, and it provides for a depopulation of the building or site between production groups. Separate-site production provides an insurance policy, in that the potential exists for "breaking" the transmission of a disease should an outbreak occur. Separate site production promotes higher productive efficiencies without the expense and down-time of repopulation in those herds in which chronic diseases have reached a level at which production is impaired. Buildings must provide a reasonable environment for the people who work in them, and routine maintenance schedules must be observed.

Nutrition technology, feed efficiency and feed costs

The feeding program in a high productivity/low variance system must be designed to economically optimize the genotype of pig employed, and must allow performance consistent with projections. If feed is mixed on the farm, quality control is in the hands of the manager and the feed mill operator. They must assure that ingredient quality and feed biosecurity meet their requirements.

The farm must have adequate feed-milling technology and management skills to ensure a consistent feed product that will support the expected performance. If feed is not mixed on the farm, bids to supply the feed can be solicited. These should be based on written specifications that require narrow tolerances of ration ingredients that are consistent with the genetic requirements and performance expectations of the herd.

Even with all of the value added today, we in the U.S. spend only 11-12% of our annual income for food. By contrast, between 55 and 65% of the total cost of production for a market hog is feed. That means about 45% of its earned income (at slaughter) must go for nutrition.

Expert nutritional assistance is needed to prescribe the correct diets. As much as is practical, given the facilities and management capabilities, this will mean a phased feeding approach which seeks to match the rations with the changing nutritional needs of the pig as it grows. Once the rations have been chosen, obtaining them in the most economical fashion becomes critical. Regardless of how careful you are to price or bid rations, annual fluctuations in the price of grains can have dramatic impacts on your ration cost. These costs are outside of management control yet can dramatically influence the overall cost of production.

Benchmarking 90th percentile farms also reveals they pay attention to quality, including feed related bio-security. These farms typically work with a nutritional consultant, their feed supplier and their genetics source to make sure the feeding program does not limit the productivity and growth or contribute to

increased variation in carcass quality. Most of these farms employ split-sex feeding to avoid overfeeding expensive ration elements to animals which do not require them. Lastly, these farms subject both ingredients and complete feeds to periodic analysis by an independent lab to ensure quality control. It seems doubtful we will ever get the pig to consume as little a percentage of its total lifetime earnings on food as we do. Moving in that direction will produce more profits and long-term staying power in this changing industry.

To summarize, the farm needs to work with an independent nutrition consultant, their feed supplier, and the genetic supplier to ensure that the feeding program does not limit productivity and contribute to variation in growth rate and carcass quality. Ration composition, ingredient source, phase-feeding, and separate-sex feeding of barrows and gilts all need to be considered. In most cases, barrows and gilts should be fed separately. Ration changes should be phased as frequently as practical and economical in order to supply the right feed mix to each category of pigs. Feed ingredients and complete feeds should be subjected to periodic, regular analysis by an independent laboratory.

Feed efficiency

Several factors influence feed efficiency in swine. Gary Allee, Professor of swine nutrition at the University of Missouri lists the following key determinants of feed efficiency:

1. Feed Wastage
2. Particle Size of Cereal Grains
3. Space-pig density
4. Health Status
 - a. multiple source pigs
 - b. AIAO vs continuous flow
 - c. mortality
5. Market Weight
6. Temperature
7. Energy Density
8. Feed Additives
9. Genetics
10. Improper Formulation and Mixing

Allee notes that Illinois researchers determined the wastage from 10 popular styles of feeders under carefully controlled conditions. The wastage ranged from 1.5 - 7.7%. Adjusting feeders, using pelleted rations and the use of wet/dry feeders conserve both feed and water.

We will demonstrate the financial impact of reducing waste and increasing feed efficiency.

Feed costs and gain

Feed costs are the greatest single cost of production. Grow-finish feed costs are the single most significant portion of the total feed bill. The issue is not as simple as getting the cheapest feed possible. The bottom-line is affected by a combination of input costs and management. Single efficiency measures such as cost of feed per cwt of gain are affected by feed costs, genetics, management, facilities employed, and rations utilized. Some of these are outside management control while others can be directly affected. When we judge feed costs as too high for a farm, it is important to realize that the solution is not always simply cutting ingredient costs or costs of the final product. The challenge is to economically optimize feeding program with the genetics employed on the farm. The process begins by understanding the genetic capabilities of the animal on the farm in combination with its grow-finish environment (facilities) and management system.

Table 1 gives the expected change in weighted average grow-finish feed costs as corn and soybean meal prices change. By selecting an average corn and soybean meal cost, the table yields the average cost per ton over all grow-finish diets for a typical phase feeding program. The costs are determined by standard ingredient costs plus a \$15 grind and mix cost. Based on USDA estimates of farm level price for 1996-97 we have used \$151.70/ton as the average grow-finish feed cost per ton. This correlates to a \$3.00/bu corn price and \$230/ton SBM.

Feed costs can be evaluated as feed costs per ton, feed costs per pound of gain, or feed costs per pound of lean gain if the required level of detail is available in the record-keeping system. Feed costs per ton can be deceptive, particularly if higher feed costs are directly correlated with better performance in the form of lean gain. While this may sometimes occur, the primary ingredients in most swine diets in the U.S. are still corn and soybean meal. For diets other than starter diets, these components will be 60 to 90 % of the diet. Corn, soybean meal, major minerals, vitamins and trace minerals, and crystalline amino acids will be the ingredients in most diets. Ingredient costs plus grind, mix,

and deliver costs make up the per ton costs of feed. Costs of each component need to be analyzed routinely in order to control per ton feed costs without sacrificing performance.

The components of feed cost per pound of gain are feed costs per ton, feed efficiency, and average daily gain. Feed costs per pound of gain will fluctuate as ingredient costs fluctuate, however, year-in and year-out, farms with good cost control programs manage to keep feed costs around \$0.22 per pound or less. To be at this level, a 250-pound market hog could incur \$55.00 in feed costs. If whole herd feed efficiency is 3.3 pounds of feed per pound of gain, 825 total pounds of feed went into producing the pig to market weight. To stay within the feed budget, feed would have to average \$0.067 per pound, or \$133.00 per ton. Feed costs per pound of lean gain can be evaluated similarly, except that the percent lean measurement from the packer kill sheet is required. Feed costs per pound of lean gain includes the impact of carcass quality as well as feed costs per ton, feed efficiency, and average daily gain.

Personnel recruitment, training and management

The final key ingredient in developing a high productivity/low variance system is recruiting good people, training them in the system of production, and managing them to their potential. The farm must be known as a good place to work. Employees that are trainable and that can contribute to the system of production should be recruited. Benefits such as true bonuses (not production incentives), health care, and retirement plans can contribute to the ability to recruit and retain people. Written job descriptions and a written employee procedure manual contribute to high productivity and low variance. Regular performance appraisal interviews, a fair and reasonable work schedule, and a competitive pay scale relative to other job opportunities in the area also contribute to employee recruitment and retention.

Simulation assumptions

Table 2.0 gives production efficiency assumptions for each of the selected percentile levels. Tables 2.1-2.3 give the detailed unit cost of production for each of the modeled farms.

A "cost driver" is shorthand for a variable which substantially impacts cost as it changes. A cost driver is an especially important variable to monitor on a continuing basis. Costs will always be creeping toward to unacceptable unless vigilance is maintained. A surprising percentage of total cost is accounted for by a few variables. For most modern farms, the primary cost drivers are feed and its related efficient use, labor cost, building and equipment, cost of debt, genetic cost, and veterinary costs. Several of these six costs are inter-related and can increase together such as labor, vet and feed costs.

Each of the tables to follow examines a major cost driver under standard assumptions. We assume that the farms hold all other levels of performance and cost at their initial levels when the target cost or efficiency factor is varied over a given range.

Table 3. illustrates the effect of varying throughput while holding other levels of performance constant.

Table 4. illustrates the effect on cost of production of various small percentage improvements in average grow-finish feed efficiency. Note that a 5% improvement in feed efficiency is worth about \$2.00 per head. It will be more for the least efficient farms. A 5% improvement represents for example, an improvement from 3.0 to 2.85.

Table 5. illustrates the change in average total cost over the life of the farm as initial construction costs for the farms are varied. Construction cost can vary due to poor negotiation, weather delays, failure to plan and inflation costs.

Typical patterns of cost and efficiency

As you examine these simulations note that some persistent patterns emerge. Note that farms which are performing well across a wide variety of cost drivers are less susceptible to wide swings in total cost of production when one factor gets out of line. Note also that the effect on lower performing farms (50th percentile) is not necessarily linear when a key driver changes along a given path. The effect can (and often is) exponential. This is primarily because of the escalating interest costs and working capital

shortages which develop on these farms. When a working capital shortage develops due to temporary drops in market prices of hogs or increases in input costs, the farm may often have to borrow money on a short term basis to pay debt or interest. This results in an exponential impact for low performing producers as costs get out of control.

Caution must be used in interpreting costs of production and comparing them from farm to farm. Some farms may report *costs of goods sold* as their costs of production. Costs of goods sold include direct costs associated with acquiring and producing an inventory during a specified reporting period. Other operating expenses, such as administrative overhead, may not be included as costs of production. Likewise, nonoperating expenses, such as interest expense, may not be included in some reported costs of production.

Other important costs

Labor costs are the second or third greatest cost of production on most farms. Labor costs per market hog have a wide range from farm-to-farm, but farms that have reasonable performance along with good cost control come in at \$10.00 to \$11.00 per head. These costs can vary by region. Facility costs (depreciation + interest) are a major cost of production, especially on new farms. Depreciation and interest costs may range as high as \$16.00 to \$20.00 per market hog on new state-of-the art farms that are highly leveraged. Utility and facility/equipment maintenance vary somewhat by region, but also with the age and condition of the facilities. Per head costs of \$1.00 to \$4.00 are not unusual. Veterinary and medicine costs are major costs on some farms. While costs as high as \$10.00 per head are sometimes observed, a competitive level is \$3.50 per head or less, for feed and non-feed medications. Administrative overhead costs vary with the accounting practices used, but may be a substantial part of total costs of production in some systems of production. They should be evaluated carefully in a financial evaluation.

Financial efficiency

The magnitude of investment required by modern production technologies coupled with the increased sophistication of pig production

systems demands a high level of production and financial management. While many producers have invested the time to keep accurate production and financial records, most will admit they lack a systematic method of using the data collected to make effective and profitable decisions.

Many producers, along with consultants and lenders, fall into the trap of examining only a few, favorite pet indicators of production efficiency like litters/mated-female/year or pigs weaned/sow/year. On the financial side, cost of production and a few balance sheet ratios are used to get a "quick and dirty" understanding of the underlying financial performance of the farm.

Likewise, farm magazines and the popular pig press typically only focus on a few measures that become a popular list of "benchmarks" for producers. Unfortunately, these measures usually focus on only a single dimension of the business such as feed to gain or preweaning mortality. These measures, while providing important information to the producer, are not comprehensive assessments of system production or financial performance although they are often used that way. They are actually subsystem measures.

Return on Assets (ROA) and Return on Equity (ROE) are true system measures of financial efficiency. This is so because every subsystem on the farm (breeding herd, nursery, and finisher) is fully represented in the numbers used to calculate ROA and ROE.

Lets take a look at how to calculate and interpret these system efficiency measures:

$$\text{ROA} = (\text{Accrual Net Income} + \text{Interest Payments}) / \text{Average total assets}$$

ROA can be thought of as the underlying return of the operation without considering the impact of the level of debt. Notice that interest is added back to Net Income so regardless of the amount of debt the farm has, it will not effect the calculation of ROA. ROA is a function of the system you have created on your farm. This includes the choices you've made regarding genetics, nutrition, environment/housing, management practices, efficiency, prices of inputs and marketing of your animals.

ROA is a true system variable since it includes comprehensive information about both the production and financial performance of the farm. Information from both the income statement and the balance sheet is needed to calculate ROA and ROE.

ROE is very similar to ROA except that interest is now included in the calculation. The formula for ROE is:

ROE = Accrual net income/Average farm equity

ROE is a comprehensive measure of system production and financial performance which specifically accounts for the effect of the level of debt used.

Accrual net income reflects the complete revenue and expense performance of all subsystems on the farm. Both measures (ROA and ROE) also use a category from the balance sheet, either assets or equity. By combining both income and expense performance from the income statement and a measure from the balance sheet, ROA and ROE capture all of the

available production and financial information about your production process in one number.

Now that we've rolled all this information into one or two key numbers we have a problem. If the value of ROE is determined to be mediocre, there is no additional information available to diagnose what area or specific problem is causing the less the desirable performance. We can unpack ROE using a construct called the DuPont equation to develop a means to diagnose and address substandard performance.

The DuPont equation breaks ROE into three parts, providing a way to audit three key areas of farm management and their contributions to ROE. The three components of ROE evaluate asset management, expense management and debt management. Managing all three of these areas well tends to maximize the value of the business. Comparing the values generated from the DuPont analysis for each of these three areas with industry benchmarks, we can begin to zero in on the areas needing attention. Once these areas have been identified, appropriate subsystem measures can be used to fine tune the identification of the problem.

The DuPont equation

$$\text{ROE} = \text{Asset Turnover} \quad \times \quad \text{Net Profit Margin} \quad \times \quad \text{Leverage}$$

$$[\text{Asset Management}] \quad \quad \quad [\text{Expense Management}] \quad \quad \quad [\text{Debt Management}]$$

where:

Asset Turnover = Gross sales/ Average Total Asset Value

Net Profit Margin = Accrual Net Income/ Gross Sales

Leverage = [1/Equity/Total Asset Value]

Let's examine each of the three components of ROE. The first is asset turnover. Asset turnover measures the speed or rate at which the system can produce sales equal to the asset value used to generate them. Asset turnover is industry specific. For lengthy, biological production processes which cannot be speeded up (like line speeds on an assembly line), asset turnover is usually low. However, there are several things within management control which affect asset turnover.

The most common limiting factor on farms today is under-employment of existing resources.

Assets already purchased and in place are often ineffectively used to generate sales. Asset turnover for a well-run, farrow-to-finish, owned (not contracted) farm will be in the 0.8 to 0.9 range or above. If your values are much lower than this, the subsystem variables to assist you in diagnosing the problem include wean-to-service interval, breeding herd mortality, non productive sow days, pre-weaning mortality, nursery death loss, average daily gain, pigs weaned per litter, days in the nursery, market weight, parity distribution, farrowing rate, finishing death loss and litters/female/year.

Second component of the DuPont equation is net profit margin. Instead of examining the level of profits we look at accrual net income standardized (divided by) by gross sales. Why standardize profits to gross sales? We can answer with another

question. If a business makes a million dollars in profits this year is that good performance? If your thinking like an economist you answered, "It depends!". If the business made a million dollars profit on five billion in sales we would consider that poor performance indeed. Hence we standardize to sales to examine profit efficiency rather than the level of profits.

The key for most farms here is expense control. Expenses overtime will tend to get out of control. This is almost universal and it applies to household finances as well as farm finances. Good long-term average net profit margins (as defined in the DuPont equation) for owned, farrow-to-finish operations are 6-9%. The key subsystem indicators of expense control are feed expense/unit of gain, feed efficiency, labor expense, interest expense, genetic expense, utilities expense and depreciation expense. In addition, on the income side, market price, percent lean and average backfat are key subsystem determinants of net profit margin.

Lastly, managing leverage is critical to maximizing the value of your business. It seems strange to some but the more equity you have, the lower ROE will be for a given level of net income produced. If you are leveraged and profitable, ROE will increase. On the other hand, if you do a poor job of asset and expense management, ROE decreases regardless of your level of leverage.

We are not recommending opening the flood gates of debt as a means to raise ROE, however,

many profitable producers are under-leveraged. Their profits betray the fact that they are actually destroying their future ability to produce earnings by failure to reinvest in the operation. A cardinal tenet of economics is that scarce resources in a capitalist economy are allocated to their most productive use. If you are a profitable producer of pork, you should consider whether you have chosen a level of debt which is less than optimal. If so, you should weigh the use of additional debt to leverage your business into a larger, and more profitable position. If you are an unprofitable producer, the opposite is the case.

Key factors and subsystem efficiency measures used in determining the optimal use of leverage are: working capital, current ratio, working capital/gross revenue, working capital/sow, total equity, term debt/equity, total debt/equity, and the use of leasing and contracting instead of owning assets. Values of the leverage measure above 2.5 must be accompanied by consistent, high profits with price risk protection or the farm can be imperiled by a working capital crisis.

Financial management using a simple construct such as the DuPont equation gives managers the ability to comprehensively assess the long-term production and financial performance of their operation. It rewards those who have taken the time and trouble to keep accurate production and financial records with a source of information to make wise decisions about their future.

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