

Data Mining to Improve the Bottom Line

Gary D. Dial, Janelle R. Roker and Stephen A. McWilliams

Prairie Grove Farms, LLC, 125 N. First Street, Dekalb, IL 60015 USA

Email: gddial@yahoo.com

■ Introduction

Improving the net profitability of a modern pork production operation is dependent upon reducing costs and/or optimizing revenues. There are numerous instances where cost reduction and revenue optimization are in conflict: for example, when finishing facility designs are compromised in an effort to save costs, resulting in the health of the growing pig being adversely affected; or when diets are cheapened such that carcass traits and growth performance suffer. If pursued in a common-sense fashion, the improvements in costs will not compromise the enhancement of revenues and visa versa. Often, when an owner/operator of a pork production company seeks to improve the bottom line of their operations, they attack only single line-item cost opportunities on the Profit and Loss Statement (P&L), anticipating that changes in financial performance will follow, even though they may not have addressed all of the opportunities or even those having the most impact. If a producer desires to capture as much as is reasonably possible of the bottom line opportunity, they must systematically analyze the revenue and cost line items, attacking those that they are either readily addressed, from a cost-benefit perspective, or those having the most impact on profitability. Regardless of the approach used, the analysis of data ("**data mining**") is required if efforts are to be more than happenstance. This paper is designed to highlight the data that should be captured and analyzed if data mining is to be done with both rigor and impact.

■ Data Mining to Enhance Profitability through Cost Management

Cost management occurs at two levels. The **first level** involves the control of the purchase price of inputs. The price of some inputs is established, often for long periods of time into the future, when the business structure is established;

for example, whether barns are owned or contracted. The price of other inputs is established through the day-to-day purchasing practices of the company. Input purchasing is typically centralized, with responsibility being seated at the level of senior management, or with staff officers hired specifically to purchase the inputs used by the farms. The farm staff typically have no influence over the cost of the inputs that their farms consume. The **second level** of responsibility occurs at the farm level, where farm staff control how many units of an input are consumed, called **“unit use.”** The office staff have little influence on the rate of use of inputs, unless they restrict how many units of an input are delivered to a farm. While it may seem intuitive, low production costs not only require that inputs be purchased competitively, **but also** that they be used sparingly. Because cost management occurs at two levels, the office and the farm must work in concert to drive out costs: the office working to purchase inputs as cheaply as possible, the farm staff working to use as few inputs as they can. If either group fails in their responsibility, cost creep occurs. Data mining is necessary to determine not only the magnitude of the opportunity that exists with a line item costs, but also whether price or use is the cause of the lost opportunity.

The following summarizes our approach to mining financial data. It is not always consistent with the financial standards suggested by the National Pork Producers Council, although we certainly do not intend to contradict any of their guidelines. We have tried to make our approach consistent with General Accepted Accounting Principles (GAAP). However, quite frankly, the real underpinning of our approach has been to develop a financial management system that is easily understood by all users of the information coming from a pork business. These include internal users, such as owners, management and production staff, and external users, such as lenders and potential investors. Regardless of the system adopted, it is essential that the type of data to be captured in each account be clearly defined. For example, supply expenses and repair and maintenance (R&M) expenses are often misclassified between the two accounts, resulting in one line item being abnormally low while the other appears abnormally high.

Purchase Price of Inputs

Let's look at some of the line items appearing on most P&Ls and determine how to “mine” their opportunity. First, we will examine those line costs that are influenced largely by purchase price of inputs. These types of inputs are not directly correlated with the volume of pigs passing through the system and usually behave as either fixed or step-wise variable costs. That is, changes in the volume of pigs passing through the system, as long as they remain in normal operating ranges, do not affect the cost. By definition, these costs tend to be sensitive to the “denominator effect,” wherein the cost/pig or cost/kg responds sensitively to changes in output. While substantially all costs

associated with breeding farms behave as fixed costs, we will discuss the following line-item costs in the context of a farrow-to-finish operation.

Facility Costs

The line item “Facility Costs” typically includes principal and interest (P&I) payments, and/or facility lease payments. It also may include contract production management expenses. Contract production fees typically are more expensive than the sum of the costs associated with barn ownership (e.g. P&I or lease-to-own payments, utility costs, R&M expenses, and labour costs). Therefore, as the percentage of barns under contract increase, relative to those that are owned, facility costs will increase. More expensively built facilities (e.g. those built in the northern U.S. and Canada) result in higher facility costs and, if not built properly, may also incur higher R&M costs due to the effects of harsh weather. As with other fixed costs, pig volume can have a significant effect on facility costs, if the number of pigs flowing through the facilities is not at budget.

Metrics used to assess the efficiency of facility use for the breeding herd include:

- % capacity utilization (breeding animal spaces available for housing breeding-age females/breeding female inventory),
- pigs weaned/breeding animal space/yr, and
- pigs or litters weaned/farrowing crate/yr.

Metrics used to assess the efficiency of facility use for the growing pig herd include those that quantify

- how efficiently barns are filled with pigs each turn, called % capacity utilization (e.g. pigs placed or sold/available spaces at a given stocking density),
- how quickly barns are turned, called barn-turn interval or turns/barn/yr (365/days from the initial filling of a barn until it is emptied and refilled), and
- marketing efficiency, which includes metrics such as pigs or kg marketed per space of per square meter per year.

Other Facility Costs

The line item cost “Other Facility Costs” is often used to segregate the non-finance portion of facility costs, such as taxes, equipment leases, dead animal removal, and facility insurance. While dead removal expense is somewhat influenced by throughput, it largely is a factor of:

- mortality rates,
- the rates charged by commercial rendering services (on a per pig, per kg, or per month basis) or

- the cost of in-house disposal facilities (i.e. composting, incineration).

Other Facility Costs are typically expressed on a per weaned pig, or per kg sold, basis. This line item expense cannot be interpreted without first knowing what it includes, and secondly, what other line item expenses are affected by what is included in Other Facility Costs.

Repair and Maintenance

As the number of pigs passing through a facility varies over time, the rate of wear and tear on both the barn and the equipment contained therein will vary nominally. Repair costs are generally constant when production flows remain near budgeted levels. Owners and management staff can expect R&M costs to increase with age of the facility and amount of investment made in preventative maintenance. As mentioned, quality and type of equipment as well as construction quality dramatically influence R&M expense. Total R&M expense can be broken down into that done by external vendors, which includes both parts and labour, and that done by farm staff, which typically includes only parts. Ignoring the potential opportunity cost associated with farm staff diverting their attention from production activities to performing repairs, farms with staff that perform the majority of repair work often have R&M costs that are a fraction of that occurring with farm using external vendors. R&M expenses are typically expressed on a per weaned pig or per kg sold, basis. Unusually high R&M costs suggest design, construction, or equipment quality issues or that preventative maintenance is not being done. Unusually low costs often indicate that preventative maintenance or routine repairs are not being done or that replacement equipment (such as feed auger motors) are misclassified as a supply expense.

Utilities

LP and propane are commodities and, thus, can be purchased in advance to lock in prices during periods of anticipated high market prices. Low stocking rates are often associated with the need for more supplemental heating, especially during the cooler months; higher stocking rates require higher ventilation rates to remove heat and accumulating moisture. The rate of use of gas and electricity often vary inversely with season: the volume of gas typically increasing during the winter months and kilowatts of electricity typically increasing during the summer months in more temperate regions of North America. Metrics used to assess the efficiency of utility use include: kilowatts of electricity or gallons of LP/propane per weaned pig or kg market pig and, of course, cost of electricity or LP/propane per weaned pig or kg market pig. Once baseline amounts of electricity and LP/propane are determined wastage and opportunities in input use can be identified (e.g. improper ventilation).

Gilts

Increasingly, replacement females destined for company farms are being produced in company-owned and managed multiplication systems in an effort to reduce both their genetic costs and costs associated with rearing. Volume discounts on genetic purchases of grandparent stock and parent boars are commonly provided to larger producers and multiple producers engaged in joint ventures. Within herd internal multiplication systems, in which gilts are produced within the herd in which they are being used, are used by some of the leading producers of North America to control gilt genetic costs, while stabilizing and/or protecting health status. Regardless of the type of internal multiplication system used, costs increase when;

- excess gilts are sold for market (i.e. wasted) rather than being retained as herd replacements,
- herd productivity is compromised due to insufficient gilts being available, as often occurs during summer breeding when the gilt development system has been sized only to meet the needs of normal replacement rates, and
- market prices for by-product barrows and non-select gilts are heavily discounted (as occurs with some genetic lines).

When gilt replacement rates are adjusted seasonally to ensure an adequate supply of gilts during the summer months, so that service targets can be maintained, gilt costs may increase seasonally during those months. Otherwise, gilt costs are not significantly affected by the volume of pigs passing through a production system. Gilt costs are higher in herds having high culling and/or mortality rates. The most commonly used metrics used to evaluate cost efficiencies for replacement gilts include: purchase price or cost of production/replacement gilt (for internal multiplication), as well as cost/weaned pig and cost/kg of market pigs sold. In order to fully understand opportunities for cost reduction, genetic costs must be differentiated from production costs.

In most financial records, the cost of replacement gilts is offset by the price received for cull sows. The cull sow market typically follows the live market hog market with prices being higher in the summer (i.e. when gilt replacement rates are highest), such that the higher gilt costs associated with increased summer replacement rates are partially, if not completely, offset by the additional cull sow revenues.

Labour

Labour costs include wages, benefits, bonuses and other incentives. Labour costs are managed through the control of starting wages, turnover rates, and farm staffing levels. Labour rates, in themselves, are all-too-often often blamed for the creep in labour costs or for labour costs being non-competitive, when manning levels and sub-optimal production are more often the primary cause.

The amount of mechanization (automation) as well as other responsibilities delegated to farm staff (such as R&M, hauling of weaned pigs or replacement gilts, and management of gilt development units (GDUs), significantly influence manning rates. Some of the metrics that can be used to better understand labour costs for the breeding herd include: inventoried breeding females/full-time employee (FTE) equivalent, hours worked/employee (corrected for vacation, holidays, and sick leave), hours worked/weaned pig, as well as labour costs/weaned pig. For the growing pig, other metrics useful in understanding labour costs include: animal spaces/FTE, annual hours worked/space as well as total labour cost/kg sold.

Supplies

Supply costs include the perishable materials and small equipment used by workers in caring for their pigs. While it is often included in Semen Costs, insemination pipettes and other artificial insemination equipment is usually included with supplies. The purchase price of supplies can be reduced with the volume discounts afforded to a large producer or offered to purchasing groups. While insemination supplies can change with number of females served, most other supplies are independent of volume changing with size of the herd and/or number of employees. Supply costs are most commonly expressed on a per weaned pig or per kg basis.

Amount of Inputs Used

The rate at which inputs are used on a farm is often regulated centrally by how much of an input is released from company warehouses. When inputs are distributed directly from commercial input suppliers, use is typically under the direct control of farm staff. When central controls are lacking, input use is largely influenced by the amount that is actually used by the animals, the amount wasted and the amount of shrink. In turn, the amount of inputs consumed directly by the animals relates directly to the volume of pigs passing through the system. For variable cost and step-wise variable costs, increasing the number of pigs produced, increases the cost of the line item in either a linear or step-wise fashion, respectively.

In order that input use is controlled for variable-cost items, a separate budget must be prepared for each input of this type, called a unit-use budget. These budgets relate the number of units of an animal product passing through the production system (e.g. pounds of pork; number of head of weaner, feeder, cull, and market pigs; number of replacement gilts or culled sows) to their projected rate of input use. For example, if we are trying to determine whether the health costs for the farrow-to-wean phase of production are too high, we will need to understand the volume of sows farrowing and the number of pigs being weaned/week. In order for input use to be understood, the involved staff, regardless of where they work in the organization, need to know how much of

an input is used by the pigs, such that wastage and shrink can be quantified. An understanding of unit use not only allows an understanding of cost-saving opportunities, but also whether there is a compliance issue (i.e. whether vaccines are being given as scheduled).

Now, let's look at some input costs that are substantially affected by rate of use of inputs. These inputs are not only influenced by the volume of pork passing through the system but usage independent of pig volume (i.e. waste, shrink) and, as with all costs, the price of the input. When budgets are used, it is often useful to partition variances of a unit-use cost from budgeted levels into that portion due to production and that portion due to cost management. The partitioning of cost into its two components allows the effects of changes in volume (i.e. production effects) to be isolated from those due to changes in the amount of wastage and shrink, and changes in the unit cost of an input. In turn, the portion of cost variance due to cost management can be broken down into that due to price and that due to variance from budget in the amount used on a per animal basis. Cost variances are expressed as either overages or underages. It is often tempting to accept underages of costs as being positive, wherein it is assumed that either cost management or rate of input use is better than budget. However, underages may reflect negative scenarios, as when vaccines are not being given as planned or an insufficient amount of feed is being provided to meet the needs of the animals.

Feed

Feed costs are, obviously, lower in geographic areas where grains are produced cheaply and where there is insufficient infrastructure (e.g. rail lines, rivers) to transport grain to distribution and processing centers (e.g. some areas of southern Minnesota and northern Iowa). Feed inputs can be hedged, options purchased, and/or ingredients purchased in advanced of need, and, if done correctly, provide price protection. A feed expense that is often difficult to decipher is the mark-up done on feed inputs (especially corn) that are purchased for inclusion in feed to make up for discounts given for manufacturing and delivery. Therefore, total cost/ton of feed delivered to the site is the best metric to be used to evaluate cost competitiveness of feed inputs. Total feed cost (ingredient costs plus grind, mix, & delivery costs) per pound of gain provides another key metric. By partitioning feed costs into those portions due to manufacturing, delivery and ingredients, opportunities can be identified and attacked to drive out costs.

As larger volumes of pigs flow through a production system, there is an increased requirement for feed. For example, when the budgeted number of sows farrowing on a herd is increased, the amount of feed required to provide for the breeding female inventory is similarly increased. Thus, feed costs increase not because of higher input purchase prices, inefficient use of the feed, or overfeeding but because of there being more animals consuming the

feed. With the growing pig, overfeeding more expensive, earlier diets, not only increases overall feed costs but specifically increase the cost management component of the cost. Thus, not only is overall feed cost/kg a critical metric for assessing growing pig feed costs, but kilograms of each diet must be understood if opportunities are to be realized. With respect to the breeding herd, overages in gestation and replacement gilt feed costs, and underages in lactation feed costs must be managed. Feed cost/weaned pig is only a fully useful metric when there is an understanding of the amount of time that replacement gilts are inventoried in the herd prior to their being bred. In addition to feed cost/weaned pig, the total kilograms of gestation and lactation diet on a per pig basis should be understood.

Health

The amount of health products used by a production system varies with the amount of pigs passing through it. Simply put: the more pigs farrowed, the higher will be the number of vaccinations and treatments required. In contrast, health service costs (e.g. diagnostic testing, site visits by veterinarians) tend not to vary with volume of pigs flowing through the system. While total health costs per weaned pig or per kg are the best overall metrics for evaluating the efficiency of health cost management, health costs should be differentiated into that portion that is due to product (both use and cost) and that due to service. In turn, health product costs should be further partitioned into those due to vaccinations and those due to medications, expressed on a per pig and per kg basis.

Semen

Semen cost is comprised of the number of doses delivered to the farm, the cost/dose and the delivery charge. Cost/dose incorporates both genetic and processing costs. When examined from a boar stud perspective, genetic costs can behave as either fixed or variable costs, depending upon how genetic premiums are paid. When genetic premiums are included in the purchase of the boar, semen genetic costs are fixed. When genetic premiums are paid according to the doses distributed from the stud, they are variable. When boar studs are operating at steady state, most costs are fixed, including such major expenses as facilities, labour, boars, and feed. Only the supplies used in processing semen varies with volume of semen produced.

The number of doses delivered to a breeding farm is a factor of the number of sows to be served during the use lifetime of that batch of semen, the number of matings/service, and the amount of semen wastage. Semen wastage is influenced by how well delivery schedules match the availability of females for breeding, and how well farm management predicts the need for semen. When an attempt is being made to maintain farrowing budgets, semen usage also varies with fertility. Semen costs should be reported on a cost per weaned pig

or kg marketed basis, and on a cost/dose basis. Calculating the total number of wasted doses, % wasted doses, and cost of wasted doses will help drive semen costs down. Expressing cost/dose of semen on a processing cost/dose basis will put additional accountability on the boar stud.

Live Haul

When transport equipment is owned by the pork production business, the cost of transporting pigs reflects the cost of equipment (depreciation and R&M expenses), operating costs (including fuel and labour), the number of loads hauled per unit time, and percentage of trailer capacity that is used. When commercial haulers are contracted to transport pigs, transport costs reflect cost/load, which usually reflects distance, and percentage trailer capacity used. Because of dynamic changes in fuel prices over the past few years, fee schedules used by commercial haulers commonly include rates adjusted for fuel prices. Dedicated load crews who travel from site to site loading pigs can be included in transport costs. Transport costs for weaned and feeder pigs can be included either with the source farm costs or the subsequent phase of production. For example, some producers include the cost of transporting pigs to the nursery or wean-to-finish barns in the cost/ weaned pig; other producers include the transport cost in the cost of producing a weaned or feeder pig. Transport costs are usually expressed on a cost per pig or kg basis. Cost/load and cost/mile are also commonly used metrics.

Manure

Building barns in geographic areas in which manure is viewed as fertilizer has resulted in manure being purchased for the cost of its land application by nearby crop farmers throughout much of the upper Midwest. As more and more crop farmers come to understand the relative benefits of organic fertilizers versus inorganic, chemical fertilizers, manure may someday be sold at a price above its land application cost. At this point, it will become a cost-offsetting revenue for production. When there is a cost to applying manure on land, as is typically the case, manure costs are expressed on a per pig or per kg basis. Metrics useful in driving out costs also include: litres of manure produced/pig and cost/litre for manure application.

■ **Data Mining to Enhance Profitability through Revenue Management**

Pork processing businesses are very different businesses from pork production businesses. While their profitability is ultimately inter-dependent, the factors that drive maximal profit in one are often at the expense of profit in the other. Marketing matrices (i.e. sort loss or weight grids) offered by processors are

designed to maximize their profit, but are typically created without any consideration for how the matrix influences the profitability of the pork producer. In fact, target weight ranges and target % lean or backfat ranges often rarely encompass the ranges yielding the maximum profit for the producer. Metrics used to maximize revenues may not optimize profits. Thus, metrics used to evaluate revenues (e.g. total revenues per head and per kg; discounts and premiums per head and per kg) should be interpreted in light of the carcass weights that yield the highest profits.

As live prices have fallen in recent years, there has been increasing pressure for producers to share in the revenues or profits generated from the sale of carcasses, primal cuts, or wholesale cuts of meat, if they are to receive an acceptable return on their equity. Such sharing of profits and revenues along the pork chain will require additional metrics to be formulated, including such terms as meat profits or revenues per pig and per kg.

■ Conclusions

In recent years, the North American swine industry has evolved rather dramatically from being largely comprised of family-farming type businesses to being dominated by large integrated meat protein producing conglomerates. Because of the dynamic changes associated with this evolution, the leaders of the swine industry have all-to-often been transaction focused: buying new assets and making new deals. As leaders of the North American swine industry are forced to manage their businesses, rather than just grow them, in an effort to become competitive, their focus will increasingly be on making their businesses sustainably profitable. As has occurred with other non-agricultural industries, understanding opportunities to increase profitability through cost and revenue management will be integral to the success of pork businesses. Data mining will be key to that understanding. You do not have to be good in mathematics to mine data, quite simply, you just have to know arithmetic and be willing to study numbers.