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Hanson Lecture: Pork production information systems and data analysis — Back to the future

Thomas E. Stein DVM, MS, PhD
MetaFarms, Inc., Burnsville, Minnesota

Introduction

I'd like to express my deep thanks and appreciation to the Swine Group at the University of Minnesota for the invitation to present the Hanson Lecture, named for Dr. James O. Hanson, an icon in the field of Veterinary Continuing Education. I first met Jim in 1979 after Al Leman had recruited me into the Swine Group and I first participated in what was then called the University of Minnesota Swine Conference for Veterinarians. Who can forget Jim's signature trademark – walking around the lobby during the Conference, ringing his cowbell to get all the attendees away from the coffee and snacks and back into the auditorium. He always made sure people got back to the sessions on time!

Jim Hanson had a passion for continuing education, and he certainly met his match in Al Leman. As soon as Al arrived at the College, he got together with Jim and said "Let's do a swine conference for veterinarians. And let's start it right now." I'll never forget the way Al would drive Jim crazy with his ideas for speakers, topics, and structure of the Conference: "You want to bring in whom as a speaker? Do you know how much that will cost?" And Al would always settle Jim down with that complete confidence and optimism we all loved and appreciated.

One of Al's big things about structuring a meeting was the 10-minute presentation. He and Jim would go around and around on this, with Jim complaining that it wasn't enough time for the speaker and Al saying the shorter the better. Anyone who's had to do it knows that Al was right!

From almost the beginning, Jim was a supporter of mine. I started doing Extension meetings around the State just after I joined the swine group. (Another of Al's big things: get the graduate students out there, doing presentations, extension meetings, and taking students out to swine farms to work with producers as consulting vets. Didn't matter, really, how green or new the graduate student was; Al was the original Nike tagline: "Just Do It.®").

I made my reputation with Jim when I hit a home run doing a couple of Extension meetings in Walker, MN – way up north, not a lot of pigs up there, which is the big reason it was me, and not Al, doing the meeting. I can't remember who called, and I can't remember what I did or said, but the next day someone called Jim and said "Who is that guy? He just gave a fantastic Extension meeting, people are buzzing up here." I was OK with Jim after that, and, of course, Al made sure I heard that feedback.

It's a tribute to Jim Hanson and his legacy that besides naming this Leman Conference keynote after him, his name also graces several other awards including the James O. Hanson Continuing Education Scholar Certificate (MN Academy of Veterinary Medical Practice), the James O. Hanson Continuing Education Scholarship, and the James O. Hanson Continuing Education Award given annually to a faculty member within the College of Veterinary Medicine, University of Minnesota.

So, thanks again to the Swine Group for this opportunity, especially Dr. Peter Davies for making this happen. And here's to the late Dr. Jim Hanson, ringing a cowbell and walking around the lobby with a smile on his face.

Road map

Because much of what I will present in this paper has been influenced by my involvement with MetaFarms, I'll start with a brief overview of the company. Of course, the experiences I had in designing and developing the PigCHAMP® software are highly relevant as well, so I'll circle back and talk about that project in the context of what we've learned and how it influenced my current thinking.

I then go on to discuss what I think is most important. It's a synthesis of what the people calling the shots are saying about the information requirements pork producers will have to meet. And that, In turn, tells producers what their information systems must do and how should be designed. Included here is my take on the key foundation functionality required, which is robust and sophisticated movement tracking.

I then will spend some time on sales and carcass information, reporting, and analysis. It's been a missing piece in many production systems and all producers need to put this functionality in place right now. Today producers who have done this are extracting extraordinary value in the form of increased revenue – and cash – per pig sold.

I think it's important to provide the lay-of-the-land when it comes to software that's used in the industry today. At the same, it's more important to think clearly through the 'make-or-buy' choice, the key decision facing production companies today (in relation to software; they have plenty of bigger decisions to make). I'll end with thoughts on benchmarking and being a world-class competitor.

MetaFarms

We founded MetaFarms in 2000 with the intent of developing new Web software applications for animal agriculture. Our big idea was to create a ***software and database foundation*** that could meet the needs of multiple species – swine, beef, poultry, dairy, and aquaculture. We focused on creating a foundation that would support enterprise-level software applications. Enterprise-level is the key point. Our thinking was driven by the belief that the live production component all animal protein businesses did not need yet another single-purpose or single-point software application. What they needed then – and need today — is a foundation and set of applications that "tie everything together." In other words, enterprise software.

At the same time, we did not want to create a new, agriculture-specific financial management and accounting system. Instead, we wanted to create software that would work with whatever accounting system a business was using. We saw that producers were moving toward new, more powerful and robust accounting software like MAS 200, Great Plains, Solomon, and even SAP and Oracle Financials. Even QuickBooks and Peachtree have become more powerful and represent fine and workable accounting system choices for small to mid-size producers.

The idea was to get the right foundation in place and then build out – on top of the foundation – particular applications targeted at particular species. We started first with applications for the pork industry (hmmm… I wonder why?). But from the start our intent was to extend the foundation into other species as we saw opportunities arise.

Another idea was to use the Internet and deliver these native Web applications using what was in 2000 called the Application Service Provider model (ASP) and what's now called the Software-as-a-Service model (SaaS). The goal was to provide our software applications as a set of online services. We would use a scalable, industrial-strength lattice-work of back-end hardware and software, and co-locate in a world-class data center.

In today's software industry, MetaFarms is what's called a "vertical market software-as-a-service (SaaS) provider." The idea of ASP's delivering software over the Internet fell out of favor (that's an understatement) following the dot-com crash of 2001-2003. (In fact, we originally used MetaFarms.com as our business name but legally dropped the.com in 2003.) Now, however, analysts and the investment community have developed a high regard for the "software as a service" business model. In terms of back-end technology, the MetaFarms approach to delivering enterprise software is exactly the same as Google's. But like SalesForce.com, NetSuite, Citrix Online (Go-To-Meeting), and many others – and in contrast to Google — we sell software rather than advertising.

Since 2000, MetaFarms has grown into a business with 9 employees; a best-practice, world-class data center partner; a large investment in the underlying technology used to provide our software services – including complete virtualization of the server farms and storage area network; a robust, underlying Web-services and database foundation for our applications; Web applications for the swine, beef feedlot, and egg-layer industries; a strong, diverse, and global customer base that includes some of the largest protein businesses in the world, as well as some of the smallest.

i-Production™ (Integrated Production Management) ™ is our set of software applications and services for the pork industry. It is built-from-scratch, Web software for managing live hog production systems. It includes applications for managing sow farms (Sow Manager™), nursery-finishing (Finishing Manager™), and sales/carcass data (Sales Manager™)[8, 30, 31, 32]

It also includes modules for managing feed data along with richly-featured and robust functionality for tracking movements, flows, and "products." i-Production™ provides interfaces to the main feed mill software programs used in North America. Customers use these interfaces each day to download feed deliveries (diets, ingredients, and costs) and automatically link it to sow farms and nursery/finishing/wean-to-finish groups.

Similarly, each day – using interfaces we've built —customers download kill sheet load (lot) summary data and individual carcass data from major pork processors and link it to their finishing/wean-to-finish groups.

Some of our database statistics will help to shed light on the volume of data being recorded and stored in i-Production™ today:

- Feed deliveries imported/week (diet + ingredients)
  4,835
- Carcass lots (kill sheets) imported/week
  1,500
- Active sows
  500,000
- Total sows (active + culls + dead)
  2,450,000

- Total sow events
  82,400,000
- No. of N/F/W-F groups (active + closed)
  50,200
- No. active nursery-finishing pigs (daily basis)
  8,000,000
- No. carcass lots (total)
  258,500
- No. individual carcasses
  24,400,000

One of i-Production's™ most important capabilities is its programmability. It's an important but (as yet) unappreciated power of native Web software (native: built using a modern Web development platform such as Microsoft. NET with programming languages like C#).

Web software providers can "expose" their application's core functionality by providing API's (application programming interfaces) for many of its underlying features and functions. You can see this today in the open programming interfaces provided by Google, Amazon, EBay, Salesforce, etc.

In our case, customers and third-parties are using i-Production™ as a platform or engine for building their own applications. Programmability is one of the outstanding features of Web software applications that are built using what are called "web services." This means that our users can create their own applications that call Web Services in i-Production™ to pull data, perform calculations, or link i-Production™ with other applications to create more powerful and proprietary "mashups." We have customers today who have used this programmability to create proprietary sales projections applications, inventory tracking applications, and automated data transfer applications.

In fact, because of the programmable nature of our software, we also have "non-customer customers". Meaning: Customers who use our software as a back-end engine to power their own internal applications. They use our services but their employees never see the i-Production software itself. A good example would be a customer who wants to use our application to manage carcass data (download, scrub for data integrity, add value by assigning things such as chronological load number, link to finishing groups) and then – using web services — pull that data automatically into their own internal software.

Currently, optimizing carcass profitability and increasing sales revenue is a big focus of customers and consultants.[1, 5, 9, 10, 11] I-Production™ and its Sales Manager™ application is the only software available that allows users to create a highly accessible and easy-to-analyze database of kill-sheet (lot) data coupled with individual carcass data. Customers use this data to model optimal carcass weight targets and manage load weight distributions, and have experienced substantial increases in revenue by using Sales Manager™ reports and analyzing their individual carcass data. Increasing revenue (and how to use Sales Manager™ to do it) has been a feature of several important training sessions and seminars put on by AASV and Elanco Animal Health over the past year.

The early years and the PigCHAMP® experience

After finishing my DVM at the University of Illinois, I arrived at the University of Minnesota in 1978 to take an innovative Internship position in Dairy and Beef Preventive Medicine with Dr. John Anderson. As a veterinary student I was drawn to herd health, epidemiology, and cattle — especially beef. Fortunately, during veterinary school I worked for three years at the University of Illinois swine research farms (the big green barns in Savoy). I was not a production manager! I started as a power washer and general go-fer but over time graduated to the breeding barn and farrowing units. Eventually I was doing a lot of breeding and covering all the breeding over the weekends.

This experience came in handy when Al Leman recruited me to join the Swine Group. It was difficult to say goodbye to cattle but the promise of working with Al, his team, and larger animal populations held sway.

I mentioned earlier Al's penchant for getting his graduate students out in the country as soon as possible – working with pork producers and veterinary practices in Minnesota and elsewhere. (Who can forget flying with Al as he piloted his Cessna around the Midwest, sometimes landing on grass airstrips? Or at Gilt Edge Farms, the 2 AM wake up call "let's go look at the pigs!")

By making me get out and act as a consulting swine veterinarian, Al unwittingly set the stage for my work on what eventually became the PigCHAMP® software.

I noticed that many of the problems pork producers brought to my attention were not disease-related. Instead, they were issues like low farrowing rate, not enough live-born pigs, slow growing pigs, and so on. Mostly they were not problems that could be solved by walking the pigs, doing necropsies, and submitting samples to the Diagnostic Lab. I started bringing hand-written sow cards and barn sheets back from the farms, and worked at home, in the evenings, to summarize the numbers and see if I could find patterns in the data.

At some point –I don't think it took very long – I said to myself "there has to be a better way" and figured that maybe the new, new thing – microcomputers – might be the answer. It just so happened that a lot was going on in

the UK at that time on that very topic (in Europe as well, but more so in the UK). Between 1976 and 1982 a slew of publications came out that were very helpful and had enormous influence on how I (and others with me) created a better way.[2, 19, 20, 21, 22, 23, 36, 38]

So, now I knew what I wanted to do for my Masters program. Since Al was my Advisor, I went into his office (I think he was eating handfuls of rolled oats from a 50-lb bag in that sat next to his desk) and announced that I wanted to create a software program for managing sows. And he said: "No." He went on to add: "We'll never have computers on swine farms. You need to do your Master's on parvovirus."[a]

Meanwhile, Dr. Harvey Hilley, one of Al's veteran graduate students, was aware of my software idea and gave me the last few thousand dollars remaining in a research budget he needed to close out. He said "just go do it." With the extraordinary help of Drs. Mike Hill and Bill Hall – two recently arrived graduate students — and support from many other members of the Swine Group, we found and hired Gerard Nimis, a graduate student programmer, to do the programming.

Soon after, with the encouragement of Dr. Ron Moser, head of the recently formed Swine Center at the University of Minnesota, we submitted a small grant proposal and received funding from the Swine Center to continue the software work.

We completed the software and named it HAMSET –the initials, in reverse, of myself and Mike Hill. We started a free data entry service bureau in my office and started to get producers to go on the system. Dr. Bill Hall brought on Dick Roney, a producer in Turtleford, Saskatchewan (Bill had been in practice for a short time up there.)[b] Dr. Bob Morrison, working with Dr. Roger Green in Faribault, MN, also encouraged several producers in their clinic area to get started. It was 1980-81, and we were up and running.[26, 29]

In late-1981, Dr. Roger Morris arrived from Australia to become Chairman, Department of Large Animal Clinical Sciences. He and his group in Australia had done cutting-edge work on software applications for dairy herd health.[6, 7, 16, 17] Soon after, he recruited me into a PhD program and became my Advisor. His charge to me was: "For your PhD thesis project and under my tutelage, create another, more sophisticated version of the HAMSET software." In collaboration with Roger and other graduate students and faculty, I began designing this new version. In 1983 I tracked down and hired (again) Gerard Nimis, the original HAMSET programmer, to do the coding for this new project.[c]

At the time, we didn't have a name for the new software; I think we were calling it HAMSET 2 or something like that. Roger Morris wanted a better name. In what turned out to be one of the most challenging parts of the entire project – I'm sure it took more than a year of weekly conversations – we went back-and-forth on possible names. At some point, Dr. Will Marsh suggested PigCHAMP®, the CHAMP being an acronym for Computerized Health and Management Program. I didn't like it (!), but everyone else on the team did, and I was out-voted. Of course, it's a great name, now recognized throughout the world.

You might not believe what I'm next going to say. The original intent of the PigCHAMP® project was to get 40 swine farms in Minnesota to use it. And we thought that was a stretch! Our idea was to collect the data annually and use it for research. Hence, the well-known "data sharing license."

We wanted to focus on two main research areas. First, understand and describe sow productivity in Minnesota swine farms. And, second, compare and contrast high- and low-productivity farms with the goal of being able to identify critical success factors that lead to high productivity.[18, 25, 27, 28, 29]

As it turned out, we were able to get 40 Minnesota farms on-board, but it wasn't as easy as you think. It took persistence and support of veterinarians around the state. And it took pork producers, most of whom at the time did not own a computer, to take a risk and try it out.

It didn't take long, however, before we realized we had a hit on our hands. We released PigCHAMP® 1.1 in March, 1985; in less than a year we had over 350 users in North America and the numbers kept growing. By the time I left the University of Minnesota and the PigCHAMP® project team in mid-1990, we had released PigCHAMP® versions 1.2, 2.0, 2.2 and 3.05 and had grown to nearly 4,000 users worldwide.[29]

New information system requirements

Fast forward 20 years. It's a new world for pork producers. Industry economics are bad now, but that will change and profitability will return. But the new world I'm speaking of has to do with information systems and new information requirements being imposed on producers even in the face of hard times.

Pork producers have to pay attention to three voices: (1) Customers, that is - Packers (packers as producers' direct customers and packers acting as proxies for the consumers' voice); (2) Lenders (and others who provide access to capital); and (3) Competitors. Because packers and lenders control the money coming in to a production business, the will set the rules and impose requirements that producers must meet. At the same time, what top competitors are doing with information systems will set the pace for the rest of the industry.

Thomas E. Stein

Information system requirements — What are packers and lenders saying, and what are competitors doing?[d]

What are the reporting and transparency expectations that pork producers will be required to meet, as set by packers and lenders, today and over the short-term future (say, the next five years?) Producers will be forced to meet these expectations.

What are competitors doing with information systems that all producers eventually will be forced to keep up with?

I've summarized key points made at a recent industry meeting in separate panel discussions among several packers and among several lenders (Tables 1, 2, 3, 4 [See Appendix on pages 22a – 22d]). In addition, I've done the same for two presentations made at recent AASV annual meetings)[2, 3, 14, 33]

In Table 5 (See Appendix on page 22e), I've summarized the key components of a modern production information system as developed and used in a more than 100,000-sow Midwest pork production system.[37] While the producer-described information system contains more production analysis details, when you lay the packer and lender requirements over the production information system description, you find that the producer-oriented production-financial requirements are in reality just a subset of the packer and lender requirements.

This is a key point. It means that if you design an information system to meet the expectations imposed by downstream customers and by capital providers, you will also meet the competitive requirements of a robust production-management information system. That's a good thing. But it doesn't work the other way around. If you focus only on the needs of production management, you'll be caught short when the time comes to meet the requirements being set by packers and lenders.

In summary, information system design characteristics mapped to the set of requirements that pork producers will be forced to meet now include the following:

1. Robust database architecture (a single place to put everything).
2. Integrated inventory flow (sow + nursery + finishing + feed + carcass + movements) that supports forward tracking, backward tracing, and projections; "product" tracking.
3. Database design to support robust production system hierarchical layout (flow, business unit, pyramid, pod, supervisors, producer/grower, site, barn, room, row, pen, crate/stall).
4. Detailed nursery/finishing/wean-to-finish group tracking
5. Integrated inventory tracking with forward and backward tracking and tracing plus linkage to outcomes; flow→ sow farms → nursery-finishing sites → nursery-finishing barns → nursery-finishing groups → sales → carcass data
6. Automated inventory roll-up across an entire production system
7. Automated projected pig flow roll-up across an entire production system
8. Integrated feed tracking; link details of feed deliveries at the ingredient level with sow farm + nursery groups + finishing/wean-to-finish groups + carcass; includes all feed ingredient detail including medications and additives. Linkage from feed delivery data back to feed mill or warehouse with additional linkage to ingredient data (lot numbers, etc). Forward and backward tracking and tracing.
9. Sophisticated and robust movement tracking; 'flow' attributes – production flow, customer flow, genetic flow, health flow, 'product' flow, etc. Must support an unlimited number of production segmentation grouping attributes that full under the rubric of flow.
10. Integrated animal treatment and antibiotic use tracking. Antibiotic purchase tracking; warehouse supply tracking coupled with integrated feed tracking. Forward and backward tracking and tracing.
11. Animal welfare measures and tracking – sampling protocols and sample or audit event recording integrated into production system database. Full compliance reporting capability.
12. Animal handling measures and tracking — integrated into movement events. Full compliance reporting capability.
13. Pre-harvest HACCP event recording and tracking; storing pre-harvest HACCP plans in database for actual v. plan reporting. Full compliance reporting capability.
14. Pig flow and projection models with granularity at the level of 'day', i.e. ability to project pig flow by day across an entire production system; automated linkage to margin models (6-month forward forecast on ingredient prices, futures prices, cash prices)
15. Cash flow models linked to pig flow models for projecting cash requirements by week (but with ability to do it by day) across an entire production system)

Movement tracking and event-product codes — Key enabling functionality

Movement tracking ends up being the key underlying technology required to meet these new requirements. But, it's not the simple movement data entry that you may be familiar with from your PigCHAMP® days or your work with other, similar software.

For example, you might think – logically - that the sale of weaned pigs would be linked to sow farms. Often, that's true (which was our version 1.0 design). But many times "weaned pigs" are sold out of a nursery or a wean-to-finish unit (I know: not supposed to happen). In fact, production systems move weaned pigs into nurseries with the express intent of selling them within a few days because the timing or logistics/transport didn't work to sell them right off the sow farm.

The same thing happens with the sales of feeder pigs out of a finishing barn rather than out of a nursery.

It gets even more complicated when, say, eight sow farm sources are contributing weaned pigs to a single truck and half the truck is going to one customer, half to another. Or, even more complicated when, say, not only are there multiple sources but there are multiple products (e.g. weaned pigs and feeder pigs) on the same truck (I know: not supposed to happen).

Our first attempts at movement recording fell far short. We did a complete re-write in order to support the complexity of tracking "products", flows, sales types, contract types, and so on and so on.

In Movements v2.0, we built in the flexibility and adaptability lacking in our first implementation. We gave users the ability to sell or move any product type, i.e. sows, boars, weaned pigs, gilts, etc. from any location, and then built error logic to check the movement integrity. Even that was fraught with danger. Question: Should you prevent the movement of a sow to a finishing barn? (Answer: No).

Design breakthroughs for movement tracking included (1) the concept of user-defined product-event codes (Table 6 [See Appendix on page 22f]) such that users can not only set up their own set of codes by product and movement-sale type but they can also specify how the product-event code should behave; (2) multiple line-items on a movement event with multiple sources, multiple destinations, and multiple product-event codes; (3) asynchronous source-destination linking.

Here's an example: Producer moves 1,500 pigs to a nursery. Producer intends to sell 500 weaned pigs from that nursery within, say, a week after moving in. Producer wants to ***exclude*** the 500 pigs sold from the calculation for the number of pigs started in the nursery. Why? It screws up that group's calculation for death loss (and other items as well). Doesn't look good on the closeout. Producer sets up a product-event code called "weaned-pig-sale from nursery" and defines its behavior as "don't count these pigs in the calculation for starting number of pigs." Producer is happy.

When you look again at the requirements list above, you can see why we made the investment to build a more robust movement tracking system. Capabilities such as…

- integrated inventory tracking,
- full forward and backward tracking and tracing,
- integrated linking of outcomes (revenue, sales, carcass) and expenses to pig flow, and
- integrated pig flow projection models

require this type of higher-level movement recording.

This level of movement functionality also supports a production management application focused on sales and carcass tracking, reporting, and analysis.

Using sales and carcass data — Who invented the cash register?

In the excellent 17-page paper describing a Midwest producers information system[37] there are only two paragraphs devoted to market hog sales reporting and kill –sheet/carcass data analysis. This highlights what I believe has been a missing piece in many live hog production information systems – the ***cash register or Point of Sale system (POS)*** and the use and analysis of this data to create extraordinary value for a business.

A cash register/POS system is not an accounting system; the data flow to an accounting software application but the cash register itself has a completely different function. The history of its invention is fascinating.[e] I first made this connection to pork production when I read the transcript of a presentation by Charlie Munger who, with his partner Warren Buffet, founded Berkshire Hathaway. He used the cash register invention to illustrate some key points about human nature as well as the type of technology they like to invest in.

It dawned on me that pork production companies don't have a cash register (I'm speaking metaphorically, not literally). It seems to me that many pork producers don't do a good job of tracking the mix of products they sell and then measuring their value. But it turns out that doing a better job at this creates real value in terms of cash flow and bottom-line company P&L. It ties in to the concept of increasing the proportion of Full-Value-Pigs™[f] as well as working to improve the business processes involved in marketing hogs with the objective of shifting the overall distribution of sales towards more higher-value pigs.

Some production companies are focusing on this. In a pre-conference session at an AASV Annual Meeting, a

large producer described their Top Hog Index reporting and analysis system.[10, 15] They track the value of each pig sold by category and rank them relative to the value of the top market hog:

Category	Relative Value	No. Pigs
Transport (pre-plant) mortality	0	
DOA, DIP (dead at plant)	0	
Subjects	0.4	
Slows	0.9	
Light hogs	0.8	
Off-grade sales	0.4	
Top hogs	1.0	

The process is simple — create a weighted average of the relative value based on number of pigs sold. This company sets a target of 93%. They figure that at a market price of $0.45/lb, every 1% increase in the overall Index generates $1.00 per pig sold of additional revenue (cash).

Currently, producers are adopting two other significant activities in relation to the use of sales and carcass data: (1) dynamic modeling of packer-specific optimal carcass weight and target weight distribution for loads being sold, and (2) real-time feedback to supervisors, barn employees, and load-out crews on actual load performance in relation to carcass weight and distribution of lights, heavies, and in-target pigs. Feedback, in the form of a report card or graph (pie-chart) of the weight distribution along with an opportunity cost calculation, is intended to reinforce the actions of getting the right pigs on the truck.

You're familiar with using a Sow Performance Monitor. Here's an example of using the same approach using sales and carcass data. Monitoring the % ideal (in-target) carcasses for each load delivered to a packer showed a drop over time from > 85% to about 50%. Using a drill-down report that showed % ideal by load cross-classified by producer-site-barn, production managers and supervisors mapped the processes being done in the barns by the most effective producers.[g] They put in place a set of Standard Operating Procedures (SOP) and an action plan that included:

- training producers and load-out crews on the issue and the SOP's.
- continuous reinforcement of the SOP's.
- using a report to provide daily feedback on shipping performance
- supervisor phone calls anytime the % ideal carcasses was < 75% in a load

The % ideal carcasses quickly moved up from 50% to an ongoing average of 87% (Figures 1 & 2). They figured this improvement was worth over $2.00 per pig sold of additional revenue (cash).

Characteristics of a world-class sales/ carcass information system

In order to capture the value from sales and carcass data, you need a sales and carcass information system. Sure, you can do one-off projects to analyze the data (if you have it), but I'm suggesting a system built to automatically provide on-going monitoring and analysis of sales and carcass data.

Data sources include (1) Kill-sheet (lot) summaries downloaded from packers or entered manually; (2) Individual carcass data downloaded from packers or entered manually; (3) Other sales data tagged with product-event codes and either entered manually or downloaded from a customer such as Parks Livestock; (4) daily markets including lean hog futures, carcass cutout reports, sow slaughter reports, spot market cash market prices, etc.

The system must have an underlying foundation that automatically…

- links packer load data back to the source of the sales (finishing or wean-to-finish groups)
- assigns a chronological number to each load sold by packer, plant, date, and process shift
- allows recording of additional details e.g. departure time, arrival time, loaded by, truck, etc.
- links the system's hierarchy (example: pyramid, pod, flow, supervisor, producer, site, and barn)
- rolls-up sales and carcass performance data across an entire system
- allows for drill-down through the hierarchy
- provides on-going comparisons to external market data
- allows for setting up packer-specific thresholds for lights, heavies, and in-target carcasses
- incorporates a robust reporting system

Figures 3 through 8 show examples of the type of reports I'm referring to when I say "robust reporting system."

Production information systems – Architecture for today and career path for the future

In the process of developing the PigCHAMP® software, I learned that any application's foundation and architecture was the most important aspect of the design. It had

Figure 1: Note the trend line of about 70% ideal hogs per load (even that is too low), followed by a substantial drop around load 90 to less than 50% ideal hogs.

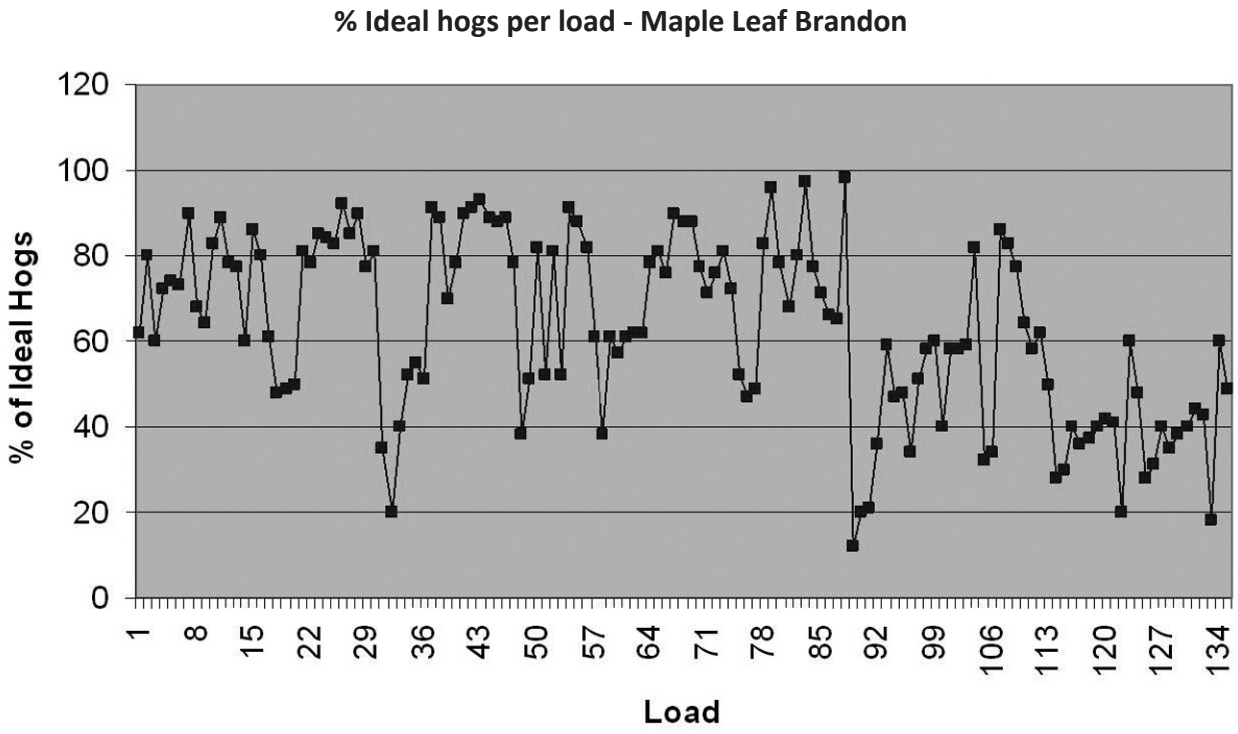


Figure 2: Process improvement in load management. Beginning around load 125 a substantial and consistent increase up to an average of about 87% with much less variation in the process outcome.

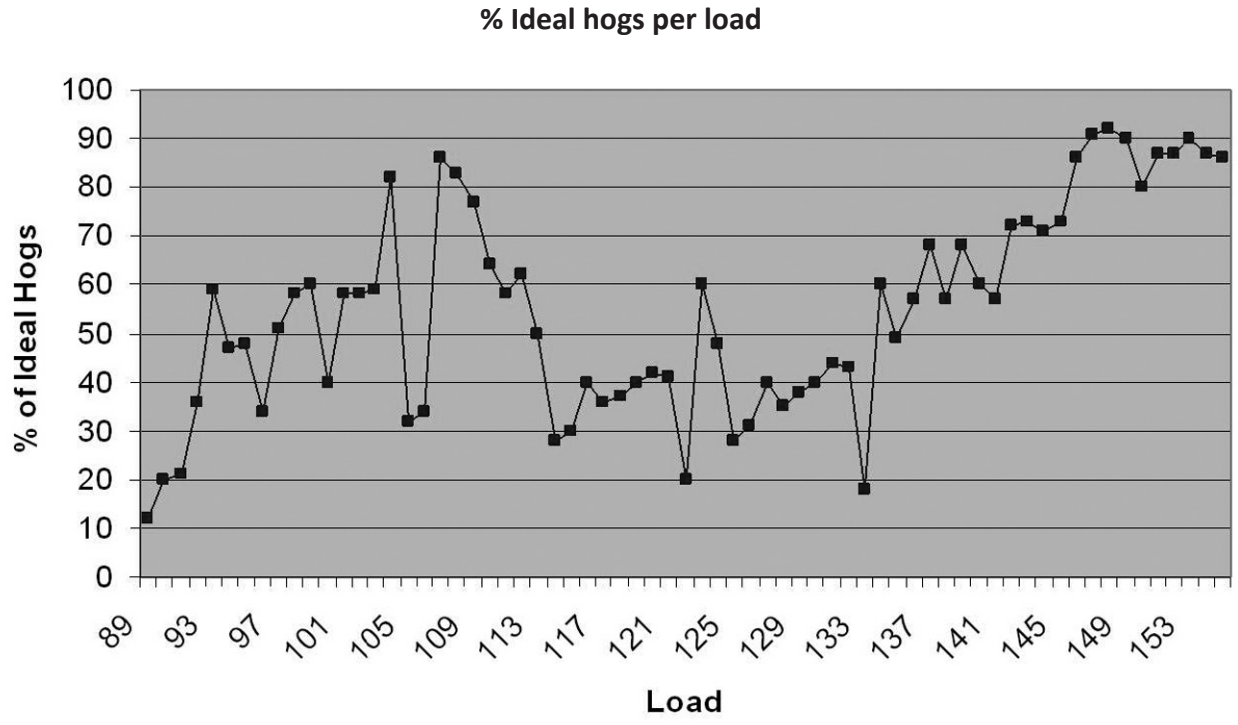


Figure 3: Graphical analysis of weight distributions during the closeout phase

Group Load Distribution

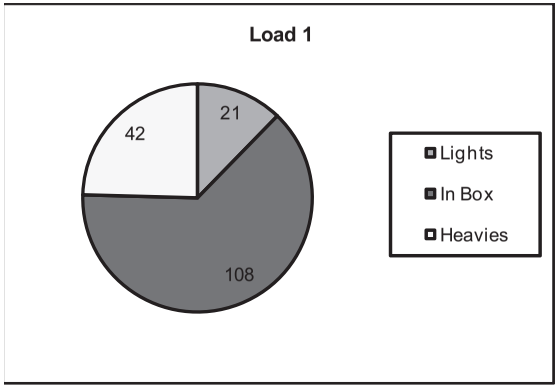
Producer: Sample Farm
Site: Sample Site
Group: 20304073

Start Date: 7/26/2004
End Date: 12/13/2004

i-Production 2.0

Received: 8/7/09 3:48 PM

Packer: Tyson
Date: 11/13/04



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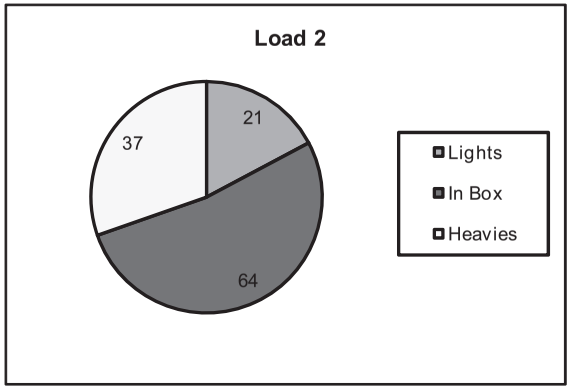

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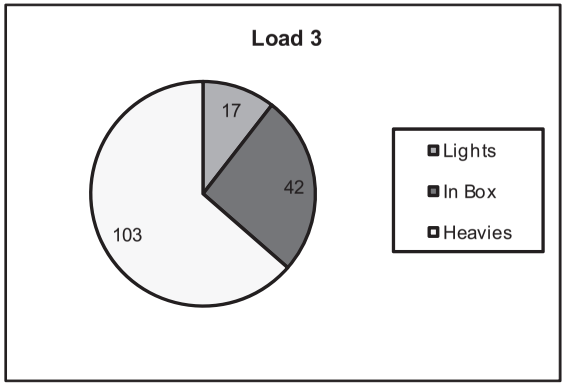

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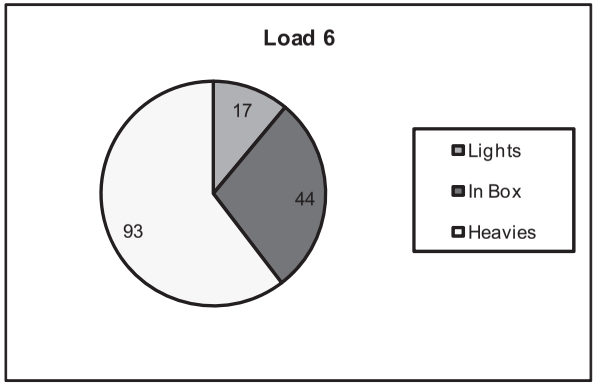

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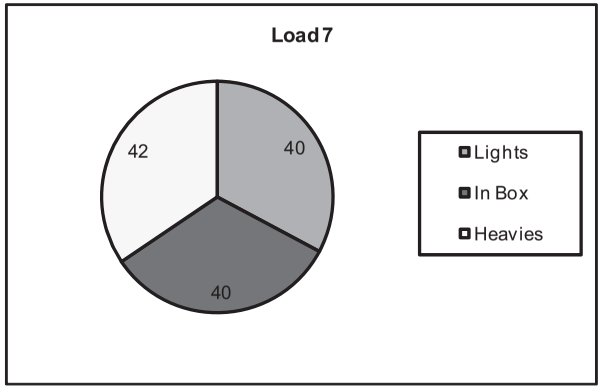

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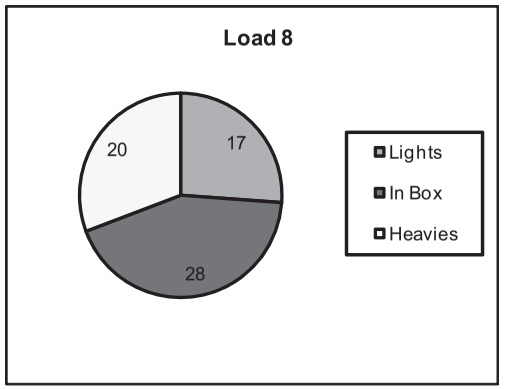


Figure 4: Kill sheet roll-up for all loads shipped from a group (1,688 pigs; 10 loads)

Summary Kill Sheet By Group
Group #: 6021092
First Load: April 12, 2006
Last Load: May 2, 2006
Days On Feed: 107

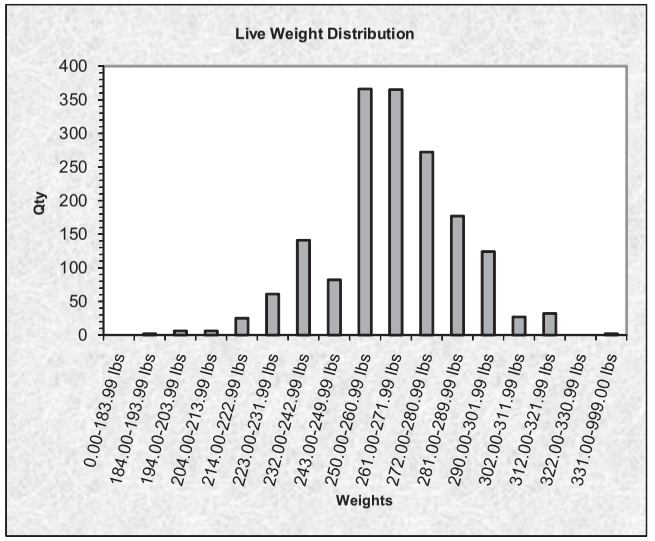
i-Production 2.00

Received: 8/7/09 4:02 PM

Summary	
Performance	**Values**
# of Carcasses	1688
Base Carcass Price	$61.39
Total Live Weight	449,178
AVG Live Weight	266.1
Total Carcass Weight	336,182
AVG Carcass Weight	199.2
Backfat	0.72
Loin Depth	2.34
Yield	74.84
% Lean	54.85%
Packer Grid Carcass Lights	516
Packer Grid Carcass Heavies	295
Company Grid Carcass Lights	516
Company Grid Carcass Heavies	295
Standard FFLI	49.70
Standard BF	0.82
Standard HCW	199.14

Company Grid Live Weight Distribution		
Range	**Hogs**	**% of Total**
0.00-183.99 lbs	0	0.0%
184.00-193.99 lbs	2	0.1%
194.00-203.99 lbs	6	0.4%
204.00-213.99 lbs	6	0.4%
214.00-222.99 lbs	25	1.5%
223.00-231.99 lbs	61	3.6%
232.00-242.99 lbs	141	8.4%
243.00-249.99 lbs	82	4.9%
250.00-260.99 lbs	366	21.7%
261.00-271.99 lbs	365	21.6%
272.00-280.99 lbs	272	16.1%
281.00-289.99 lbs	177	10.5%
290.00-301.99 lbs	124	7.3%
302.00-311.99 lbs	27	1.6%
312.00-321.99 lbs	32	1.9%
322.00-330.99 lbs	0	0.0%
331.00-999.00 lbs	2	0.1%

Total Hogs 1688
Total In Box 1003



Group Totals				
Summary	**Total**	**Per Hd**	**Per Carcass CWT**	**Per Live CWT**
Total Base Value	$206,428.79	$122.29	$61.40	$45.96
Total Sort Loss	-$2,889.94	-$1.71	-$0.86	-$0.64
Total Carcass Value	$213,348.01	$126.39	$63.46	$47.50
Expenses				
Trucking/Freight	$3,314.37	$1.96	$0.99	$0.74
Insurance	$1,290.90	$0.76	$0.38	$0.29
State Weighing	$219.83	$0.13	$0.07	$0.05
Pork Checkoff	$860.60	$0.51	$0.26	$0.19
Voluntary PPC	-	-	-	-
Misc Deduction				
Contract Adjustment				
Bug Bite				
Net Payment	$207,662.31	$123.02	$61.77	$46.23

Company Grid Carcass Weight Distribution		
Range	**Carcasses**	**% of Total**
0.00-139.99 lbs	0	0.0%
140.00-147.99 lbs	3	0.2%
148.00-154.99 lbs	6	0.4%
155.00-162.99 lbs	7	0.4%
163.00-169.99 lbs	44	2.6%
170.00-176.99 lbs	60	3.6%
177.00-184.99 lbs	157	9.3%
185.00-189.99 lbs	232	13.7%
190.00-198.99 lbs	292	17.3%
199.00-206.99 lbs	323	19.1%
207.00-213.99 lbs	269	15.9%
214.00-220.99 lbs	160	9.5%
221.00-228.99 lbs	86	5.1%
229.00-236.99 lbs	35	2.1%
237.00-243.99 lbs	12	0.7%
244.00-250.99 lbs	0	0.0%
251.00-999.00 lbs	2	0.1%

Total Carcasses 1688
Total In Box 884

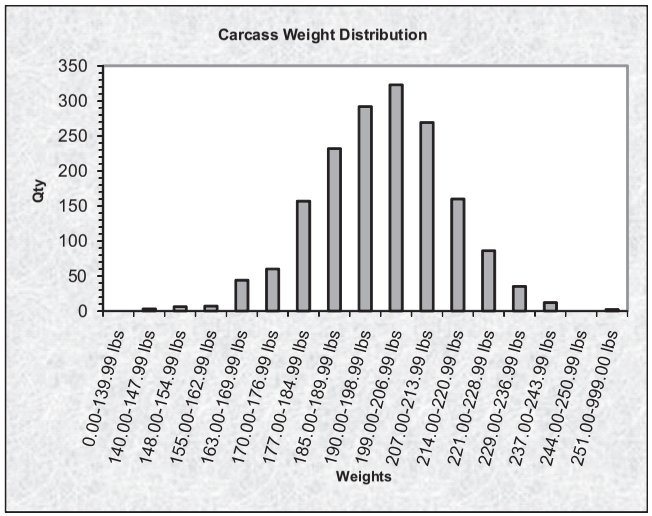


Figure 5: Reporting weight distributions by load allows for quick analysis of employee performance.

Group Load Distribution i-Production 2.00

Producer:

Site:

Group: 20567894

Received: Oct-18-2005 8:55 PM

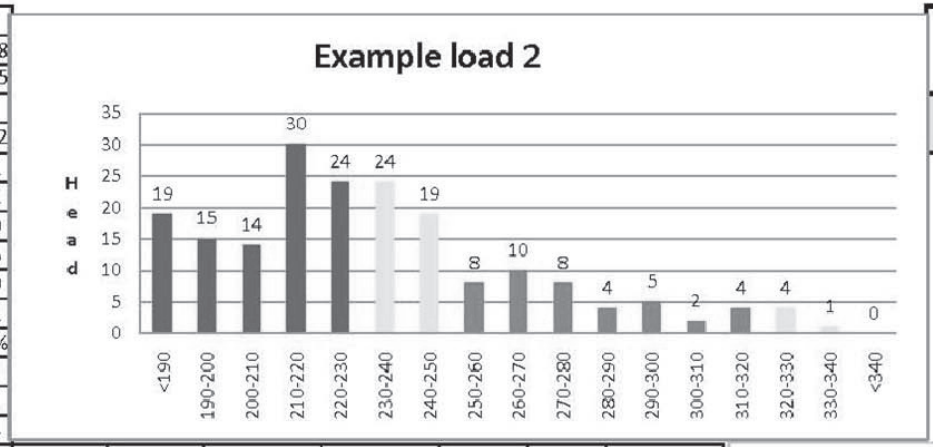
Total	171	172	185	180	183	183	183	183	164	165	162	1931
Avg Wt	248	243	250	253	252	246	259	265	239	245	252	251
Total In Box	69	69	87	101	91	63	96	102	43	60	72	853
% In Box	40%	40%	47%	56%	50%	34%	52%	56%	26%	36%	44%	44%

Packer:	Swift	Swift	Swift	Swift	Swift	Swift	Swift	Swift	Swift	Swift	Swift		
Load #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**	**% of Total**
Date:	*8/26/05*	*9/1/05*	*9/1/05*	*9/10/05*	*9/15/05*	*9/15/05*	*9/16/05*	*9/16/05*	*9/19/05*	*9/19/05*	*9/20/05*		
Live Wt													
< -- >			1								3	4	0%
175				1								1	0%
180		1										1	0%
185		2		1					1			4	0%
190		1				1						2	0%
195		2	1	2		2			2	1		10	1%
200		2	2	1	2	3		1	2			13	1%
205			1	1	3	2	2		10			19	1%
210		6		2	5	10	1		3	2	3	32	2%
215	7	1	4	3	5	1	2	6	7	12	8	56	3%
220	1	6	5		5	10			9	3	1	40	2%
225	12	11	9	12	6	2	8	3	19	13	16	111	6%
230		3		3	4	18	3	2	4		7	44	2%
235	26	23	28	15	24	18	10	10	42	32	13	241	12%
240	2	35	1	6	11	14	6		6	1	1	83	4%
245	43	7	38	18	17	16	22	14	11	37	24	247	13%
250	13	36	3	30	3	25	7	14	3	9		143	7%
255	24	5	41	8	28	12	34	20	14	22	28	236	12%
260	1	19	1	28	3	12	2	1	8	7	3	85	4%
265	21	2	29	5	20	2	31	32	10	11	33	196	10%
270	6	4	6	24	25	13	3	18	6	2	11	118	6%
275	5	7	10	3	12	9	21	17		7		91	5%
280	2	2	3	6		1	18	12	5	4	6	59	3%
285	1	2	1		4	8	1	8		1	6	32	2%
290				6	4	1	9	9	2	1	2	34	2%
295		1	3	1	2	1		9			2	19	1%
300	1			4			1	1				7	0%
305						2	1	4				7	0%
310								2			1	3	0%
315							1					1	0%

You can see in this example (real data), mistakes on the front-end of the group close process. Ideally there would be very few lightweight pigs in the early loads. Ideally the final loads should not include heavy pigs. Some producers determine an opportunity cost based on comparing the actual weight distribution against a target distribution.

Figure 6: Reporting weight distribution by load using a "Report Card" format (thanks to Dr. Steve Dritz for this example)

Example load 2	
Kill Date:	1/7/08
Load ID:	218045
Site Code:	Ex 456
Site Name:	Ex load 2
Carcass Base:	51.31
Paid Head:	192
Carcass Weight:	34,299.0
Avg. Carcass Weight:	178.6
Live Weight:	232.0
Est. Live Weight:	44,544.2
Yield percentage:	77%
Lean %:	54.7
Head not paid:	1
Lost ID animals	4



Last Diet Cost/T
$ 190.00

Lost ID CWT value	49.17	Lean %	Fxd/hd	Lean$/hd	Total $	$/Hd	$/CWT	$/CWT live
<190	19	56.5	(6.18)	3.84	1,106.51	58.24	42.43	32.67
190-200	15	55.6	(6.78)	3.67	951.00	63.40	42.06	32.39
200-210	14	56.3	(6.59)	4.44	992.13	70.87	44.63	34.37
210-220	30	56.0	(5.83)	4.36	2,400.41	80.01	48.37	37.24
220-230	24	54.2	(4.61)	2.83	2,091.98	87.17	50.29	38.72
230-240	24	55.1	(3.41)	2.72	2,200.70	91.70	50.93	39.21
240-250	19	55.2	(3.14)	4.19	1,857.39	97.76	51.87	39.94
250-260	8	53.6	(2.33)	2.87	808.84	101.11	51.58	39.72
260-270	10	53.8	(1.16)	2.82	1,059.28	105.93	52.13	40.14
270-280	8	54.4	(0.15)	3.65	898.74	112.34	52.96	40.78
280-290	4	54.0	0.86	3.51	469.52	117.38	53.29	41.04
290-300	5	53.2	1.17	3.00	598.59	119.72	53.16	40.93
300-310	2	52.1	2.36	1.33	248.65	124.33	52.35	40.31
310-320	4	49.8	3.20	(2.07)	479.97	119.99	49.48	38.10
320-330	4	49.3	3.80	(2.89)	483.79	120.95	48.62	37.44
330-340	1	49.2	4.73	(1.86)	126.46	126.46	48.83	37.60
<340	0	-	-	-	-	-	-	-
Load Totals/Average	191	54.9	(3.79)	3.27	16,773.96	87.82	49.16	37.85
Opportunity: revenue lost due to light pigs on this load:					$2,003.11			
Opportunity: revenue lost due to heavy pigs on this load:					$14.29			

TRIUMPH GRID REPORT CARD

RED light = Don't work at all

YELLOW light = should be on last load, barn cleanout

GREEN = Right On!

YELLOW heavy = should have been sooner

RED heavy = Oh, no!!!!

Figure 7: Monitoring report for sales and carcass performance-Production numbers

Sales Performance Monitor

MetaFarms i-Production

Packer:	**Example**				
Production Year	**2008**	**2008**	**2008**	**2008**	**2008**
Production Quarter	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
Start Week	**Dec-29-2007**	**Mar-29-2008**	**Jun-28-2009**	**Sep-27-2008**	**Dec-29-2007**
End Week	**Mar-28-2008**	**Jun-27-2008**	**Sep-26-2008**	**Dec-26-2008**	**Dec-26-2008**
No. Loads	2,375	2,243	2,166	2,584	9,368
No. Market Hogs	378,140	359,052	356,228	415,792	1,509,212
Ave Load Size	159.2	160.1	164.4	160.9	161.2
No. Dead	176	240	338	180	934
No. Condemned	536	584	352	632	2,104
No. Deduct	0	0	0	0	0
No. Paid Carcass	377,428	358,228	355,538	414,980	1,506,174
Delivered Lbs	0	0	0	0	0
Paid Live Lbs	100,154,875	94,489,524	93,624,095	110,055,888	398,324,382
Paid Carcass Lbs	75,050,106	70,953,944	70,038,251	81,798,942	297,841,244
Avg Live Weight	265.4	263.8	263.3	265.2	264.4
Avg Carcass Wt	198.8	198.1	197.0	197.1	197.8
Yield %	75.0	75.1	74.8	74.3	74.8
Backfat	0.66	0.69	0.69	0.68	0.68
Lean %	56.0	55.4	55.4	55.5	55.6
No. Carcass Lights	103,768	103,150	114,356	135,052	456,326
% Carcass Lights	27.5	28.9	32.2	32.5	30.3
Sort Loss Contribution $	(81,189)	(83,256)	(102,541)	(89,068)	(356,054)
Sort Loss Contribution %	15.3	18.4	23.4	19.2	19.1
No. Carcass in Target	250,692	237,630	223,554	259,020	970,896
% Carcass in Target	66.4	66.4	63.1	62.5	64.6
Sort Loss Contribution $	(144,356)	(127,141)	(120,729)	(125,776)	(518,003)
Sort Loss Contribution %	27.3	30.3	27.5	26.2	27.8
No Carcass Heavies	22,968	17,448	17,628	20,908	78,952
% Carcass Heavies	6.1	4.7	4.8	5.0	5.1
Sort Loss Contribution $	(313,001)	(227,084)	(231,133)	(288,433)	(1,059,651)
Sort Loss Contribution %	57.4	51.3	49.1	54.6	53.1

Figure 8: Monitoring report for sales and carcass data-Financial numbers

Sales Performance Monitor

MetaFarms i-Production

Packer:	**Example**				
Production Year	**2008**	**2008**	**2008**	**2008**	**2008**
Production Quarter	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
Start Week	**Dec-29-2007**	**Mar-29-2008**	**Jun-28-2009**	**Sep-27-2008**	**Dec-29-2007**
End Week	**Mar-28-2008**	**Jun-27-2008**	**Sep-26-2008**	**Dec-26-2008**	**Dec-26-2008**
No. Loads	2,375	2,243	2,166	2,584	9,368
No. Market Hogs	378,140	359,052	356,228	415,792	1,509,212
Avg Live Weight	265.4	263.8	263.3	265.2	264.4
Avg Carcass Wt	198.8	198.1	197.0	197.1	197.8
Yield %	75.0	75.1	74.8	74.3	74.8
Backfat	0.66	0.69	0.69	0.68	0.68
Lean %	56.0	55.4	55.4	55.5	55.6
PER HEAD (PAID)					
Base Value	110.79	135.99	141.75	115.14	125.92
Lean Premium	6.99	6.31	6.30	6.42	6.51
Sort Loss	(1.44)	(1.20)	(1.27)	(1.22)	(1.28)
Total Value	116.4	141.1	146.8	120.3	131.2
Trucking/Freight	2.85	3.03	3.07	3.04	3.00
Insurance					
State Weighing	0.06	0.06	0.06	0.06	0.06
Checkoff	0.47	0.57	0.60	0.49	0.53
Vol PPC					
Misc Deduct					
Bug Bite					
Contract Adj					
Net Pay	114.16	138.61	145.95	120.02	129.68
PER CWT CARCASS					
Base Value	55.72	68.66	71.96	58.40	63.68
Lean Premium	3.52	3.19	3.20	3.26	3.29
Sort Loss	(0.73)	(0.60)	(0.64)	(0.62)	(0.65)
Total Value	58.52	71.24	74.54	61.04	66.34
Trucking/Freight	1.43	1.53	1.56	1.54	1.51
Insurance					
State Weighing	0.03	0.03	0.03	0.03	0.03
Checkoff	0.24	0.29	0.30	0.25	0.27
Vol PPC					
Misc Deduct					
Bug Bite					
Contract Adj					
Net Pay	57.42	69.98	74.09	60.87	65.59
MARKET COMPS					
ECB	49.90	68.04	73.79	54.34	61.52
WCB	52.87	70.63	76.04	56.22	63.94
ISMN Cash	52.84	70.62	76.05	56.10	63.90
National Carcass (WA)	51.85	69.78	75.28	55.47	63.09
Nearby Lean Hog Futures $	57.86	72.54	74.58	59.36	66.09

to be architected for flexibility and adaptability so that it could be extended, grow with new learning and new requirements, and not hit a structural and design-imposed dead-end. Hence, in PigCHAMP® we incorporated an event-oriented data structure and an accordion-like design of the data file, which seem to have worked out OK.

As the team at MetaFarms approached the design of i-Production™, the need for a solid, underlying architecture was the overarching design rule. Our first task was to create a software and database foundation that could meet multiple needs, both within and across species.

Our design goal became simple yet challenging — create a place to put everything, meaning build an underlying database structure which could become a place to store all the data associated with running the live-side of an animal protein business. Then, we would build a 'Big Engine'™ with the ability to render whatever functionality was needed, fueled by the data stored in the 'place-to-put-everything.' This creates ultimate flexibility and adaptability, and creates an underlying design with a multi-generation (> 25-year) "career path".

There's an important reason we went that direction. It was becoming clear that pork producers would be obligated to meet new and additional information requirements that would go far beyond fundamental production management. Earlier I presented a set of requirements that are coming but producers haven't yet been forced to comply. They will be. At the same time, we can count on more, yet-unknown requirements coming in the future.

Under these circumstances, a production company should be asking itself questions like:

- How do we get out of reactive mode?
- What foundation should we put in place that will reduce our cost of infrastructure?
- What is the current 'cost-of-production' for our reporting, compliance, and analysis functions?
- What are the risks we face with the way we currently have implemented our information systems? (Keep in mind that one under-appreciated risk factor is unreasonable dependence on a key person who "knows how to put reports together", "run the system", "get the data out", and so on)

Production software applications used today

Table 7 (See Appendix on page 22g) lists fifteen software applications that I'm personally familiar with and are used today in the North American swine industry. (I apologize if I've left any off the list; it was not intentional.)

For many years, veterinarians and producers have had the luxury of having to learn the calculations and understand the reports for only a few applications. In fact, because it was such a dominant application for so long, if you knew PigCHAMP® that was all you needed to know. We've clearly entered a new software era, and I believe there will be even more applications added to this list over the next few years. Keep in mind that none of these applications are orphans; all are being used to more or less extent across the industry today.

The decision to buy or build your own

Earlier, I talked about the new information system requirements that are and will be imposed on producers. The biggest conundrum among producers today – in relation to software and information systems – is the ***'make or buy'*** decision.

Keep in mind that tools like Microsoft Office (or newer alternatives like OpenOffice or Zoho Office or Google Docs and Google Apps) are the workhorses in all businesses and maybe to an even greater extent in pork production companies. When it comes to tracking nursery and finishing groups, feed, and kill sheets, MS Excel and MS Access are the glue that holds many production companies together. At the same time, industrial-strength hardware and software database applications are more accessible than ever before.

So, it's tempting to go the 'make' route. Most IT staff will immediately go for the 'make' decision because every one of them thinks they can do it better than any outside software company. Always. For some production companies that truly have an outstanding IT team in place (e.g. Bill Greenley and Swine Graphics), it may make sense. But don't kid yourself; you will be on a cost treadmill. I think the jury's still out on whether it makes sense in the long run. But over time the industry will learn whether it does or not.

You should keep in mind this simple set of decision criteria if you have a client wrestling with the make or buy decision:

Buy for competitive parity

Build for competitive advantage

In other words, it makes no financial sense to invest in building software internally if it's a matter of keeping up with your competitors ***and*** you can purchase effective off-the-shelf solutions, especially if your competitors are using the same solution.

On the other hand, if you have a project that in some way gives you a competitive advantage, then you should build it.

Caution: if the idea surfaces from the IT group, don't just take them at their word. Do the due diligence to confirm that it's something that truly will bring a competitive advantage. (Apologies to any IT people reading this!)

Assuming it's a buy decision, how do producers decide what application to use? And how should you guide them in that decision?

Making a software decision has become more complicated now that the industry has moved to multi-site production with standalone sow production under different ownership than the follow-on finishing flow. And, in fact, finishing flows may be standalone from sows and from packers. The decision ***may*** seem to depend on where you participate in the production supply chain, but that's only in the short-run and only if you're a standalone sow producer or system.

If you're a vertically integrated production system, fundamentally the decision has been made for you already – you have to switch to an enterprise system. The reasons revolve around cost – cost of compliance and cost of infrastructure.

You could take the approach of throwing bodies at the data and using labor to re-purpose, re-format, and package the data so that it complies with your downstream customer's requirements. In fact, it may appear to be the cheapest short-term solution. But it's not – because it's not just a one-off project, it's something you have to keep doing. So now you've created a new function that requires additional employees, and all of a sudden your infrastructure cost goes up. And you will continue to be faced with and forced to comply with additional requirements, which means hiring more people. It's a losing proposition in the long-run.

If in the production supply chain you sit in the first position upstream from a packer (owner of finishing or owner of a farrow-to-finish system), then you have a bit more flexibility depending on your size. The smaller you are, the less costly it might be to take the manual approach to data integration. But don't kid yourself; it will take at least one full-time position no matter how small you are. Once you hit about 5,000 sows, you can figure one additional person and then another for every 3,000-sow jump beyond that. That's not counting data entry or production supervisor positions.

If you're in the second position upstream – a standalone sow producer or system — one way of thinking goes like this: all I need is a single-point application like PigCHAMP® Care, PigKnows™, PigWin™, etc. I need sow cards, action lists, and the reports, and that's all. Since most of the sow software out there today does just about the same thing, the decision is about personal preference and cost (the cheaper the better).

There's a lot to be said for that way of thinking. It does remind me, though, of something a 10,000-sow producer in Iowa said to me a few years ago. They were finishing pigs only until they bought the sow farms supplying their weaned pigs. As he told me: "When we were buying weaned pigs, we required the sow farms to vaccinate sows and pigs for everything we could think of — and we made them eat the cost. But the first thing we did after buying the sow farms was take out most of the vaccinations. We didn't want the cost."

The point is that the more downstream you are (finishing is further downstream than sows, and processors are more downstream than finishing), the more your decision-making has to take into account higher-level factors.

But If you're a standalone sow system and say goodbye to the pigs at weaning, (the thinking goes) you don't need to care what's going on downstream. You've got no dog in that hunt.

A flaw, however, is that sooner or later – and probably sooner – the downstream customers will force you to link up to their enterprise software. Because in turn they will be forced by their customers to have a link all the way back to the sows.

At that point, as a standalone sow system, your decision will be based on cost of compliance and cost of infrastructure in the same way I talked about earlier.

Benchmarking

A five-year, continuous data mining project I did for PIC and the PigTales group – a great experience – gave me an insight that changed my entire frame of reference on this topic:

Even within a single genetic line, there is as wide a distribution in overall sow farm productivity (PWMFY, liveborn average, etc) as there is between genetic lines or, for that matter, between production systems across the entire industry.

"Huh." This was one of those experiences I'll never forget; it stopped me in my tracks. And made me re-think my theory of how competitively successful production systems do it. And it made me re-think the goals and benefits of performance comparisons (benchmarking).

I had been under the (naïve) impression that if you put an excellent genetic line in your production system, you were good-to-go; in other words, you'd achieve performance levels typical of that genetic line (more precisely, the outcome distributions associated with particular performance parameters for that line e.g. total litter size or individual growth rate).

I experienced the same thing over-and-over again. I would mine large databases, and time after time reach the same conclusion. And it didn't matter whether it was sow data or nursery data or finishing data. My conclusion was always this: Yes, there are significant performance differences from top to bottom, and there's a big gap between the Top and Bottom 10% (or 25% or 33%), and there's

nothing in the database that provides insight into what really propels a sow farm or a production company into the high-performing top tier.

I agree that it's useful to know where you rank in relation to competitors, and it can be used to motivate everyone in a company from the Board of Directors to the farrowing technician. But motivation only goes so far; you need to be able to have answers to the question: "what do we actually have to do to improve performance?" And, in my opinion, you will not find the answer in benchmarking reports.

Comparative performance numbers, whether they are financial or biological, are simply the "clinical signs" of success or failure. However, they do make important contributions, one of which is this: They show what's possible and they show its distribution; that's a good and useful thing (assuming you can trust the calculations, the data, and the procedures used to derive the numbers).

Much like lab test results are starting points in clinical diagnosis, numbers like a $50 weaned pig cost or 25% preweaning mortality or 70% farrowing rate or $35 nursery cost or 20% finishing mortality or – you get the picture – are only starting points. Benchmarking comparisons may be able to get you down a level or two – maybe you can isolate factors such as purchasing cost differences or vet-med cost differences – but sooner or later you have to drill down to what's happening in the barns (or at the office in the case of purchasing). Sooner or later you need to put in place actions or interventions at that level to improve performance.

Eventually, I came to another conclusion — that the answer is embedded in the hundreds of daily processes that take place within a production company. The answer is about effective training and management of people, not only of individuals who perform the tasks but also for managers and supervisors. At the end of the day, it is about company culture, discipline, and persistence in execution. Talking about this subject always reminds me of a quote from the CEO of Dayton's, the company that owned Target and other department store brands: "We don't have to be twice-as-good as our competitors to win; we only need to be 1% better in 1,000 different areas."

I read through some of the benchmarking literature as applied in industries outside of production agriculture. It helped me understand what I was looking for when I hit a dead-end in my data mining activities. I wanted to find what the benchmarking field calls process enablers – the hundreds of details that go in to the successful execution of business processes. The problem was… they aren't captured in benchmarking databases! (Table 8 [See Appendix on page 22h] shows some benchmarking principles that have influenced my thinking.)[34]

The 'ah-ha' for me was their definition of benchmarking's goal – ***discovering process enablers, which lead to insight, which you turn into action.*** I like the emphasis on action because at the end of day an information system is simply a tool that enables this process of discovery, insight, and action. I also resonate to the idea that simply finding significantly better practices is good enough. In other words, not every process has to be world-class and you don't have to exhaustively search for the very best practices. Just find processes that are better than what you're doing today and give you the highest "return on attention."

Armed with my new understanding, I started talking with senior managers at large pork production companies about the idea of process benchmarking. Their reaction was interesting. I'd sum it up as "there is no way we will ever share with our competitors what you call our process enablers. That's what gives us our competitive advantage." And, they're right. It reminds me of one of Anderson Consulting's corporate principles: "We'll share everything [publicly] except our client's insight."

One the other hand, process enablers eventually do leak out of production companies. People change jobs and bring that knowledge and insight along. Others present information at industry meetings that contain insight on better production processes.[i] However, senior managers, I think, are correct in not sharing their insights (I know I wouldn't if I were in their shoes!). Even though insight will slowly disseminate, it's an example of what the late Peter Drucker, well-known management guru, called "innovators profits." He made the point that almost all internal innovations eventually find their way to competitors… but there's a time lag. It's during this lag that the innovator will extract profits and competitors won't. Meanwhile, there's no reason for the innovating company to try to shorten the lag time.

The bottom-line: Benchmarking is useful but insight is better. Spend a lot more time and money going after insight.

Being a world-class competitor in pork production

General Electric's operating definition of a world-class competitor is, I think, highly relevant for senior management at large pork production companies. In the mid-1980's, Jack Welch, former CEO and Chairman, wanted to know how successful companies positioned themselves for continuous improvement. He asked an internal GE benchmarking team to find out.[35] They ended up doing an in-depth study of nine companies for three years – and reached the conclusions in Table 9 (See Appendix on page 22i).

The relevant take-home lesson — for this presentation — is the focus on knowing your processes better than your competitors know theirs. That sums up one of the major advantages, I believe, of putting in place an integrated

information system. I hear it from our customers all time: "We thought we knew our business well, but after we started using your software we learned that we didn't know our processes very well at all. Now we do."

Producers who go this direction will, of necessity, gain a much deeper understanding of their business processes. In turn, this will make them a better competitor because as they learn they will most likely improve at the same time.

Footnotes

a) Working with Dr. Ross Cutler I did a forgettable project on the economic analysis of parvovirus vaccination. As was ultra-characteristic of Al, within a few years he was a complete advocate of computers and information systems for pork producers. By the mid-1980's, he was working closely with Swine Graphics, spent a sabbatical year there, and in 1987 left the University of Minnesota to become a partner with Gene Barrick at Swine Graphics.

b) I believe Dick Roney was the first user on the HAMSET software and went on to become the first producer to go on the PigCHAMP software.

c) I still find this set of circumstances amazing: Gerard Nimis is an extraordinary software developer. He was a graduate student when Dr. Bill Hall first found and hired him to work on one of Bill's projects. Once we had some money for HAMSET, we hired him to code it. The amazing part—here was a young man who (a) grew up on a hog farm, (b) had an undergraduate degree in Animal Science, and (c) was finishing a double-major Masters in Computer Science and Animal Breeding (with Bill Rempel, well-known swine geneticist). You could search for years and not find someone with that set of experience and skills. In addition to coding PigCHAMP, Gerard went on to create Statistix, an award-winning statistical analysis software application. He and his family now live in Florida, where he continues to update and enhance the Statistix software.

d) By the way, you may notice something — there is very little that pertains to sow event recording and the analysis of sow records. for example, there are no references to parity distributions, non-productive days, or matings per service analysis. Of course, these types of analysis remain important because sow farm efficiency drives weaned pig flow. But today this is assumed to be managed well, and what's more important is sow farm inventory, breedings, total pigs weaned, and projected weaned pig flow.

e) The cash register was invented in 1879 by James Ritty, a saloonkeeper in Dayton, Ohio. Ritty's invention caught the eye of John H. Patterson when he purchased several machines for use in his retail store. Patterson bought the rights to Ritty's invention and started a company called National Cash Register (NCR). He tells the story as to why cash registers became a necessity for his business: "We were obliged to be away from the store most of the time so we employed a superintendent. At the end of three years, although we had sold annually about $50,000 worth of goods on which there was a large margin, we found ourselves worse off than nothing. We were in debt, and we could not account for it, because we lost nothing by bad debt and no goods had been stolen. But one day I found several bread tickets lying around loose, and discovered that our oldest clerk was favoring his friends by selling below the regular prices. Another day I noticed a certain credit customer buying groceries. At night, on looking over the blotter, I found that the clerk had forgotten to make any entry of it. This set me to thinking that the goods might often go out of the store in this way-without our ever getting a cent for them. One day we received a circular from someone in Dayton Ohio, advertising a machine which recorded money and sales in retail stores. The price was $ 100. We telegraphed for two of them, and when we saw them we were astonished at the cost. They were made mostly of wood, had no cash drawer, and were very crude (Ritty's Incorruptible Cashier). But we put them in the store, and, in spite of their deficiencies, at the end of twelve months we cleared $6,000."

f) Trademark of Elanco Animal Health

g) This would be much like the process of monitoring overall sow farm performance with a Performance Monitor, identifying a problem (drop in farrowing rate, for example) and then using a Parity Distribution report to start the diagnostic process.

h) Here's where having the HAMSET experience was very helpful. I'll never forget the design conversation between me and Gerard Nimis – we needed to decide how many parities to allow within a complete sow record, i.e. before she was culled or died. (In those days, data storage space and RAM were so small that every bit counted.) Between us, we figured that the average sow stayed in the herd for about 3.5 parities, so we decided that if we doubled it – all the way up to 7! – there would be plenty of room for all the parities in a long-lived sow's lifetime record. Oops! It became a severe limitation and without a complete re-write of the file structure, would have kept HAMSET from ever having any long-term success.

i) In fact, one might say that consulting veterinarians are the ultimate disseminators of information on process enablers that improve production practices. It's what technical meetings are all about. Proceedings from meeting like this along with industry trade publications contain a lot of information about process enablers. But there's a catch; the information isn't easy to access because it's not indexed in that way. (Now there's an interesting project for a veterinary or graduate student – or even our Association – to take on!)

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Table 1:

Key Points – Packer Panel [oral presentations]. National Pork Industry Conference. July 2009	Requirements of an Information System
Welfare is king -- producers need to show and be held accountable for following established ethical principles. NPB "We Care" program -- Tyson Fresh Meats (TFM) publicly endorsed in June 2009.	Animal welfare measures and tracking integrated into production system database Animal handling measures and tracking integrated into movement (loading) data
Even in this period of high input costs, we (packers) are placing more requirements on our producer-suppliers. Headlines (media) are driving these new requirements.	
Hormel will require antibiotic use data from all producer-suppliers; all suppliers must report total antibiotic use in feed and water for all antibiotic products used.	Integrated animal treatment and antibiotic use tracking Antibiotic purchase and use tracking; warehouse supply tracking Integrated feed tracking; link details of feed deliveries at the ingredient level with sow farm + nursery groups + finishing/wean-to-finish groups + carcass; includes detail on feed medications/feed additives
Pig producers need to formalize in your businesses the excellent industry-initiated programs (WE CARE responsible pork initiative; PQA Plus; TQA, Environmental Stewardship). This means detailed documentation, detailed records, and third-party validation.	- Robust database architecture (a single place to put everything) - Integrated inventory flow (sow + nursery + finishing + feed + carcass + movements) that supports forward tracking, backward tracing, and projections; “product” tracking - Database design to support robust production system hierarchical layout (flow, business unit, pyramid, pod, supervisors, producers, site, barn, room, row, pen, crate/stall) - Integrated feed tracking; link details of feed deliveries at the ingredient level with sow farm + nursery groups + finishing/wean-to-finish groups + carcass; includes detail on feed medications/feed additives - Sophisticated movement tracking; ‘flow’ attributes – production flow, customer flow, genetic flow, health flow, ‘product’ flow - Integrated inventory tracking; carcass data linked to sow farm, nursery-finishing producer-site-barn, nursery-finishing group, and flow
Consumers want reassurance; consumers (and therefore packers) want verification of good management practices from producers.	
TFM will require all producer-suppliers to be PQA+ certified by June, 2010.	
Hormel will require all suppliers to be PQA+ certified by Site by December 31, 2009	

Table 2:

Key Points – Lender Panel [oral presentations]. National Pork Industry Conference. July 2009	Requirements of an Information System
We want accurate, worst-case cash forecasts from hog producers: how much cash will it take to get you through, what's your burn rate?	Robust database architecture - a single place to put everything Integrated inventory flow (sow + nursery + finishing + feed + carcass + movements) that supports forward tracking, backward tracing, and projections Database design to support robust production system hierarchical layout Pig flow model (granularity at the level of 'day' = projected pig flow by day across entire production system) linked to margin model (6-month forward forecast on ingredient prices, futures prices, cash prices) Cash flow model linked to pig flow model (projected cash requirements by day across the entire production system) Automated inventory roll-up across entire production system Automated projected pig flow roll-up across entire production system Detailed nursery/finishing/wean-to-finish group tracking Sophisticated movement tracking 'Flow' attributes – production flow, customer flow, genetic flow, health flow, 'product' flow
Use hedging right now even if it means locking in losses, you need to minimize the downside risk and protect the downside cash flow	
Regulators are looking for a lot more accuracy on our loan ratings Our credit standards will become more strict in 2010; we have to protect the quality of our loan portfolio	
Communication is key. Hog producers must keep us informed, especially on working capital levels. We want to see your budgets and rolling forecasts, and we want quarterly updates (this is new, we haven't required this before).	
"Don't show me production information. Good production is a given. It's not about production anymore. Get that through your heads."	
Ww want to see your projections -- cash flow, balance sheet, working capital, P&L; focus especially on cash.	
We want to see breakevens by lot (nursery, finishing, wean-to-finish groups), by flow, by business unit, by total system.	
Timeliness is key. Get breakevens and projections to us for last month by mid-month (e.g. by mid-July, we want to see June actuals and your re-forecast for the next 12 months based on YTD actuals)	
You (pig producers) must upgrade your financial reporting, you need to invest money in financial reporting.	
We want to see 12-month cash flow projections and rolling forecasts of your daily crush margins for the next 6 months (yes, for each day).	
Many U.S. producers are at 26 pigs weaned/sow/year with overall death rates at 5% or less (circovirus vaccine has improved productivity a lot). Message: we don't need more productivity!	
Most of the hog producers in our loan portfolio are at 20 to 21 pigs marketed/sow/year. Message: we are very happy with that level of productivity!	

Table 3:

Key Points: Challenges and Changes in the Swine Industry -- A Packer's Perspective. G. Louis. 2006.	Requirements of an Information System
We are in the early stages of the "information age of pork"	Robust database architecture (a single place to put everything) Integrated inventory flow (sow + nursery + finishing + feed + carcass + movements) that supports forward tracking, backward tracing, and projections; "product" tracking Database design to support robust production system hierarchical layout (flow, business unit, pyramid, pod, supervisors, producer/grower, site, barn, room, row, pen, crate/stall) Integrated feed tracking; link details of feed deliveries at the ingredient level with sow farm + nursery groups + finishing/wean-to-finish groups + carcass; includes detail on feed medications/feed additives Sophisticated movement tracking; 'flow' attributes – production flow, customer flow, genetic flow, health flow, 'product' flow Integrated inventory tracking; carcass data linked to sow farm, nursery-finishing producer-site-barn, nursery-finishing group, and flow Integrated animal treatment and antibiotic use tracking
All parts of the pork production chain will become more transparent to all sectors of the food chain	
Need to develop the ability to link any piece of pork to a database of verified specifications regarding its composition and the inputs and practices employed during production	
Meat retailers will receive information on product attributes: genetics, pork producer, production site location, feed ingredients, veterinarian in charge of health, nutritionist in charge of feed programs, health protocols, processing date, processing location.	
The government will require the ability to trace every piece of pork back to the origin sow farm, and associate the pigs with the specific lots of ingredients and medications used in those pigs	
Producers must have tracking systems that are good enough to support full traceability. Biggest gap right now? On-farm antibiotic medication records.	
Producers must be able to "backstop" or substantiate claims made in relation to traceability, animal welfare, food safety, and niche product attributes.	
Producers need robust information systems for tracking "out-of-compliance" pigs	
Processors will require trace back to producers for source of poor quality pork, foreign materials, etc.	
Performance measures are very poor indicators of animal welfare levels, especially in the face of disease challenges.	Animal welfare measures and tracking integrated into production system database
PQA Plus will not be good enough. Producers need to have a site-specific pre-harvest HACCP plan with third-party validation.	Pre-harvest HACCP action tracking; pre-harvest HACCP plan in database for actual v. plan reporting
Processors will perform downstream audits as pigs come in to a plant (antibiotic residues, broken needles, foreign material e.g. staples or plastic ties used to repair ruptures; wire in mouth); chemical residues.	Carcass data linked to sow farm, nursery-finishing producer-site-barn, nursery-finishing group, and flow

Table 4:

Key Points – The Pork Value Chain – A view from inside a branded food company. M.D. Terrill 2008	Requirements of an Information System
To survive and succeed in pig production today, you have to have the ability to meet or exceed standards of production performance that the very best producers reached just a few years ago.	Organized to support and improve production efficiency and competitiveness
What used to be seen as "non-core" issues [meaning not relevant to production and financial efficiency] have become highly important -- animal welfare, animal handling, environmental stewardship, sow housing, food safety, traceability, employee health and welfare, and community relations.	Robust database architecture - a single place to put everything Integrated inventory flow (sow + nursery + finishing + feed + carcass + movements) that supports forward tracking, backward tracing, and projections "Product" tracking
Pork processors and pig suppliers together will identify and rank primal yields and boning yields by source, i.e. unique combinations of genetics, flow, health, feeding programs, etc.	Database design to support robust production system hierarchical layout Sophisticated movement tracking 'Flow' attributes – production flow, customer flow, genetic flow, health flow, 'product' flow Integrated inventory tracking; carcass data linked to flow
Processors will work closely with suppliers to combine data mining in live production company databases with more powerful statistical algorithms and more sophisticated in-plant technology	
Processors will work with their suppliers to pro-actively manage incoming carcass weight distributions with the goal of optimizing the flow into and profitability of the processor's product portfolio	
Processors and suppliers are working closely to evaluate and rank meat quality metrics by pig source (pH, color, drip loss, IM fat content)	
"Technical sales" {to meat buyers) have and will become much more important; the technical sales group will provide more detailed information about their product's attributes including farm-level data	

Table 5:

Key Points – Identifying and Communicating Key Drivers of Financial Performance to Production Management. S. Weiss. 2005.	Requirements of an Information System
The profitability of a swine enterprise is most significantly influenced by on-site production management	Enterprise-wide model of production flow Projected marketing – next 6 months, next 10 months, next 18 months Model downstream production flow based on space availability, density requirements, and seasonality of ADG Database design to support robust production system hierarchical layout (flow, business unit, pyramid, pod, supervisors, producer/grower, site, barn, room, row, pen, crate/stall) Sow event records Detailed nursery/finishing/wean-to-finish group tracking and closeouts Robust movement tracking Integrated inventory flow Expenses data linked to nursery/finishing/wean-to-finish group Expenses data linked to sow farms Expenses data linked to corporate "container" Allocation of corporate-level expenses to sow farms, N/F/WTF groups P&L, cost-of-production reporting by sow farm, N/F/WTF groups, rollups across entire production system Sow farm P&L reporting, including actual-budget-variance comparison per farm, cost variance and throughput variance comparison across sow farms Daily, weekly, monthly sow farm reporting Daily, weekly, monthly N/F/WTG group and total system reporting Mortality exception reporting: death loss > 4%, death loss < 2% by supervisor Track end-of-week feed bin inventory levels Feed budgets stored in database; Report to compare actual v. budget Feed budget exception reporting: actual v. budget variance by producer and supervisor Calculate dynamic targets for ADG, FCR, feed cost/lb gain based on average in and out weights, season Automatic download of feed deliveries with full ingredient detail Database design to accumulate lot (kill sheet) and individual carcass data Automatic download of packer sales/carcass data Report card for each load sold Report to compare carcass and load results by producer, group, supervisor
The most successful businesses in the world are those that have superior information systems. Most swine businesses lack this.	
Production flow and predictability of flow is the most critical element of an operating plan	
Accounting software is not adequate or capable of meeting the requirements of a full operations information system including production flow, production efficiencies, inventory rollups, and projections	
Sow farms track daily: breedings, abortions track weekly: breedings, abortions, pigs born live, pigs weaned, conception rate, farrowing rate, pre-wean mortality, weaned/litter, weaning age, breeding projections, inventories – sows, piglets in lactation, boars, gilts in GDU's track monthly: P&L (weaned pig cost); cull rate, death rate, non-productive days; wean-1st service interval; LMFY; PWMFY; PWFY Projected breed groups for next 6-8 weeks based on expected number of weaned sows, projected unbred sows in heat, projected repeat services, and projected gilts in heat	
Nursery/Finishing/Wean-to-Finish groups track daily: dead, water use, sales track weekly: dead, culled, sales, inventories, facility utilization %, feed usage track monthly: P&L, sales, carcass lot rollup closeouts: mortality %, cull %, ADG, FCR, feed cost/lb gain, first-in/last-out days, total days, group closeout P&L	
Sales & Carcass Daily: sales, average weight, sort loss, carcass weight distribution (lights, heavies, in-target or "box" Weekly, Monthly: above plus % yield, % lean	

Table 6: Examples of User-Defined Product-Event Codes

Sow Sale (Boner) 903
Sow Sale (DOA) 908
Sow Sale (Heavy) 901
Sow Sale (Junk) 904
Sow Sale (Light) 902
Sow Sale (No val) 907
Wean Pig Sale (Full Contract) 801
Wean Pig Sale (Full Spot Mkt) 800
Wean Pig Sale (No val) 807
Wean Pig Sale (Partial Value) 806
Wean Pig Transfer 811
Antibiotic-Free / Wean Pig Sale (Cull) 503
Antibiotic-Free / Wean Pig Sale (Disc) 502
Antibiotic-Free / Wean Pig Sale (Full Contract) 501
Antibiotic-Free / Wean Pig Sale (Full Spot Mkt) 500
Antibiotic-Free / Wean Pig Sale (No val) 507
Crate-Free / Market Hog Sale (Cull) 303
Crate-Free / Market Hog Sale (Disc) 302
Crate-Free / Market Hog Sale (DOA) 308
Crate-Free / Market Hog Sale (Full Contract) 301
Crate-Free / Market Hog Sale (Full Spot Mkt) 300
Crate-Free / Market Hog Sale (No val) 307
Crate-Free / Market Hog Sale (Roaster) 304

Table 7: Production management software applications used in the North American swine industry ca. 2009

i-Production	Integrated sows, N-F-WTF groups, kill sheets, individual carcass, movements, feed	Single database for all production entities within an organization and all companies using the software	Native Web app; online; realtime reporting across all entities, organizations using the application	MetaFarms, Inc.(US) www.metafarms.com
PigCHAMP Care	Sows, handheld	One database per "farm"	Windows app local install no ability to rollup across databases	Farms.com (Canada) www.pigchamp.com/
Agrosoft	Sows, electronic sow feed systems	One database per "farm"	Windows app local install; no ability to automatically rollup across databases	Agrosoft (Denmark) www.agrosoft.dk
PigWin	Sows	One database per "farm"	Windows app local install; no ability to automatically rollup across databases	Agrovision (Netherlands) www.agrovision.com/
Swinebooks	Sows	One database per "farm"	Windows app local install; no ability to automatically rollup across databases	Agrovision (Netherlands) www.agrovision.com/
Farm NL	Sows	One database per "farm"	Windows app local install; no ability to automatically rollup across databases	Agrovision (Netherlands) www.agrovision.com/
PigKnows	Sows			Colorado Data Systems (US) www.csddata.com/
Porcitec	Sows	One database per "farm"	Windows app local install; no ability to automatically rollup across databases	Agritec (Spain) www.agritecsoft.com/en/
Herdsman	Sows (pedigree)	One database per "farm"	Windows app local install; no ability to automatically rollup across databases	S&S Programming (US) www.sspro.com
G-F Pro	N-F-WTF groups, kill sheets, feed	One database per customer	Windows app local install; no ability to automatically rollup across databases	Herdstar (US) www.herdstar.com
SmartBreeder SmartFeeder	Sows N-F-WTF groups, kill sheets, feed Integrated with TransactionPlus accounting	Multiple databases	Windows app no ability to automatically rollup across databases	FBS Software, Inc.(US) www.fbssystems.com/
AgriSoft AIM	Animal inventory management	One database per customer	Windows app local install; no ability to automatically rollup across databases	AgriSoft/CMC (US) www.agrisoftcmc.com
LotTracker	N-F-WTF groups Integrated with accounting	One database per customer	Windows app local install; no ability to automatically rollup across databases	Delfax Solutions, Inc. (US) www.delfax.com
Feed Allocation System	Feed budgets Feed ordering	Single database for all customers	Native Web app; online realtime reporting	Prairie Systems (US) www.prairiesystems.net
SDI	Inventory, mortalities, feed orders	Collecting data via cell phones	Interactive voice response	Safe Data, Inc. (US) www.safedatausa.com

Table 8: Key principles of strategic benchmarking.

Benchmarking is a continuous search for and application of ***significantly better practices*** that leads to superior competitive performance.
The reason you benchmark is to learn and improve. Benchmarking's final step is to convert your new knowledge into action – make changes to the key business processes that have your attention and focus.
Benchmarking, done strategically, gives management two thing: comparative performance numbers AND a description of what practices – exactly – lead to the exceptional performance. These practices are called "enablers".
Enablers represent the theory (the "how" and "why") behind the process performance.
It's not necessary or cost-effective to benchmark every process. Focus on the ones with the highest potential for "return on attention." Not every process needs to be world-class.
There's a low ROI on benchmark numbers presented without their context, i.e. the process enablers that allowed the performance to be achieved.
Managers may misuse benchmark analysis and demoralize their employees by exhorting them to achieve "stretch" goals without the context; that is, they don't provide the process enabler information.
The ***real*** job of management is business process improvement. Which means the ***real-real*** job is the continuous pursuit of business knowledge.
Benchmarking's real goal is to discover process enablers because they are the key to improving a company's performance.

Table 9: GE Operating Definition of a World-Class Competitor

Knows its processes better than its competitors know their processes
Knows the industry competitors better than its competitors know them
Knows its customers better than its competitors know their customers
Responds more rapidly to customer behavior than do competitors
Uses employees more effectively than do competitors
Continuously competes to increase market share