

**ALTERNATIVE MODELS FOR THE FUTURE
OF PORK PRODUCTION**

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PART I - THE TRADITIONAL PRODUCER CENTERED CHANNEL

Pork production in the U.S. has typically taken place on diversified "family" farming operations where the operator independently makes virtually all the critical production and marketing decisions. The decisions include the breeding stock genetics, feeding programs, health programs, the facilities used, farrowing cycles and all other key production decisions. Marketing decisions such as time of sale, weight at sale, and the choice of packer have also been made independently by individual operators. In nearly all cases, these producer level decisions were made in response to open market prices on both the input and output side of the market.

The demand in the input markets and the supply in the output markets have been largely determined as an aggregated result of uncoordinated decisions by individual producers acting independently. Suppliers have responded to the input demand, packers have slaughtered and processed the supply farmers placed on the market and consumers have purchased the available quantity supplied. Open market prices have served as the coordinator for the system through a set of broadly defined commodity grades. (see figure 1)

Several conditions have served as a foundation for the producer centered commodity pork production systems (figure 2). These conditions taken together have made the decentralized independent producer system the dominant means of production in the U.S. through most of its history.

First this system has been the low cost means of production. No competing system has been willing or able to match the cost performance of the system. Second, the independent producer system has had the capability to finance the production of all the pork demanded by consumers. Third, most independent producers have had open access to production technology

Figure 1

Traditional Independent Producer Centered Market Channel for Livestock

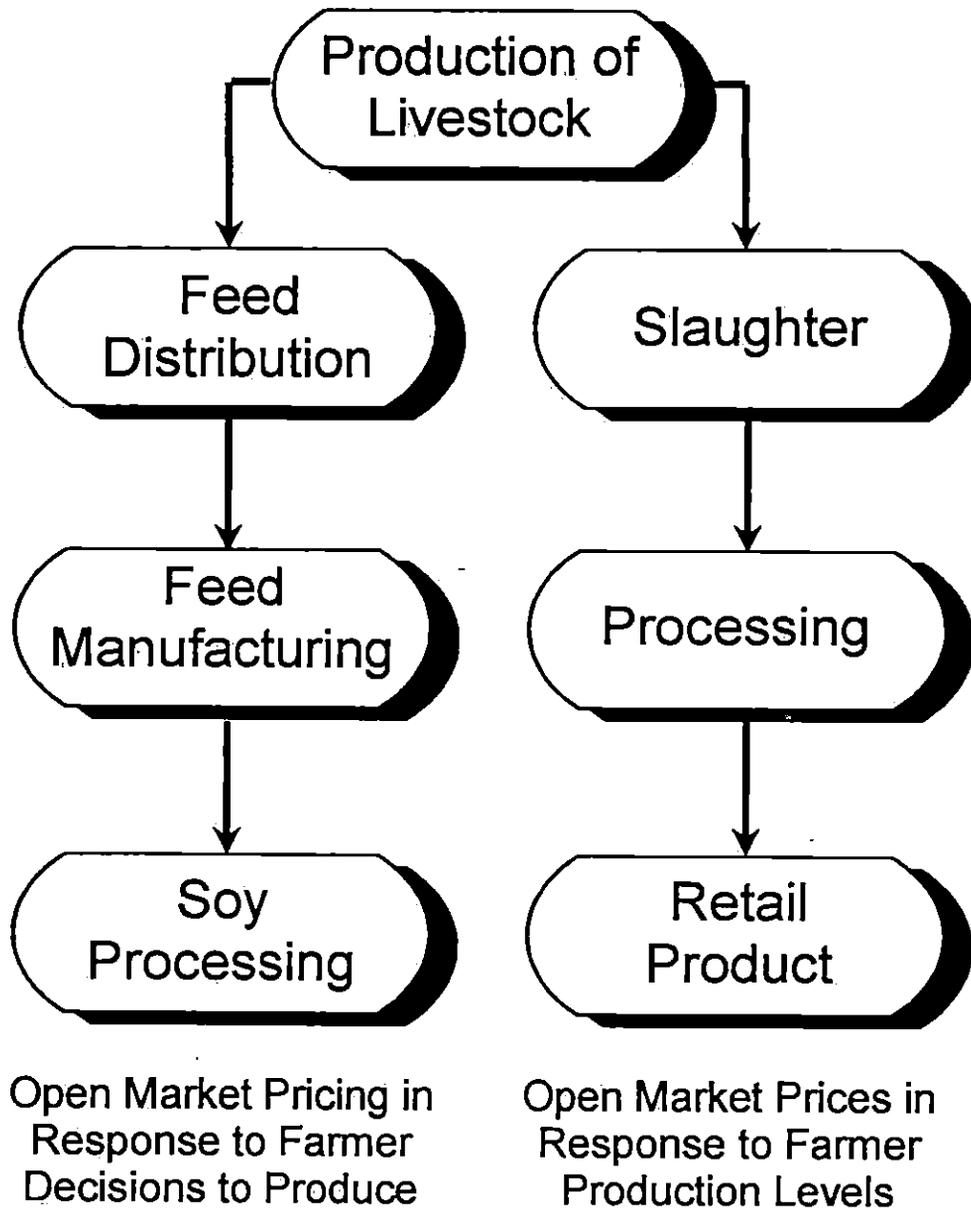


Figure 2

FACTORS SUPPORTING TRADITIONAL SYSTEM

- 1. FARMER POSITION AS LOW COST PRODUCER**
- 2. INDEPENDENT FARMER CAPABILITY TO FINANCE PRODUCTION**
- 3. ACCESS TO PRODUCTION TECHNOLOGY AND GENETICS BY FARMERS**
- 4. ACCESS TO COMPETITIVE OPEN MARKETS BY INDEPENDENT FARMERS**
- 5. LITTLE OF NO COORDINATION IN THE SYSTEM BY LARGE FIRMS**
- 6. CONSUMER ACCEPTANCE OF PRODUCT AS PRODUCED**

and genetics on a competitive basis. Beyond that, independent producers have had open access to slaughter markets and until recently, no significant attempts had been made by large firms to coordinate the production and marketing of hogs. Finally, consumers have been willing to purchase the product the system produced with prices adjusting to move the volume produced. But these conditions may not be assured in the future.

Virtually every one of these critical underpinnings has been challenged in one way or another over the past decade. Low cost coordinated systems have developed outside the midwest and are moving into the core hog production areas of the corn belt. New technology and production practices including uniform genetics, three site production, phased feeding, split-sex feeding and all-in-all-out occupancy have raised the fixed cost commitment for farrow-to-finish operations. Entry of at least one large poultry integrator and large industrialized producers have also resulted in unequal access to production technologies and genetics. Research and development activities are increasingly lodged in the private sector rather than the USDA and Land Grant Universities where public access is assured. Research findings and even operating efficiency measures are increasingly treated as proprietary information and are largely unavailable to the independent producer sector.

While markets remain open and the majority of the volume still originates from independent producers, the number of hogs sold by large contractors has steadily increased over the past decade and continues to accelerate. Large industrialized producers and contract integrators such as Premium Standard Farms, Seaboard, Tysons, Con Agra (Monfort), Cargill, and Smithfield have entered the market. Integrated and industrialized operations are in a

position to increasingly operate outside the commodity hog markets and rely on internally controlled production. Large production contractors are in a position to bring large volumes of hogs into open markets and command price premiums.

Finally, the consumer sector is demanding low cost, high quality, consistent retail pork cuts and products. Increasing per capita consumption of chicken and turkey products imply that pork must meet similar cost, quality and nutritional standards if it is to maintain or increase its per capita consumption levels.

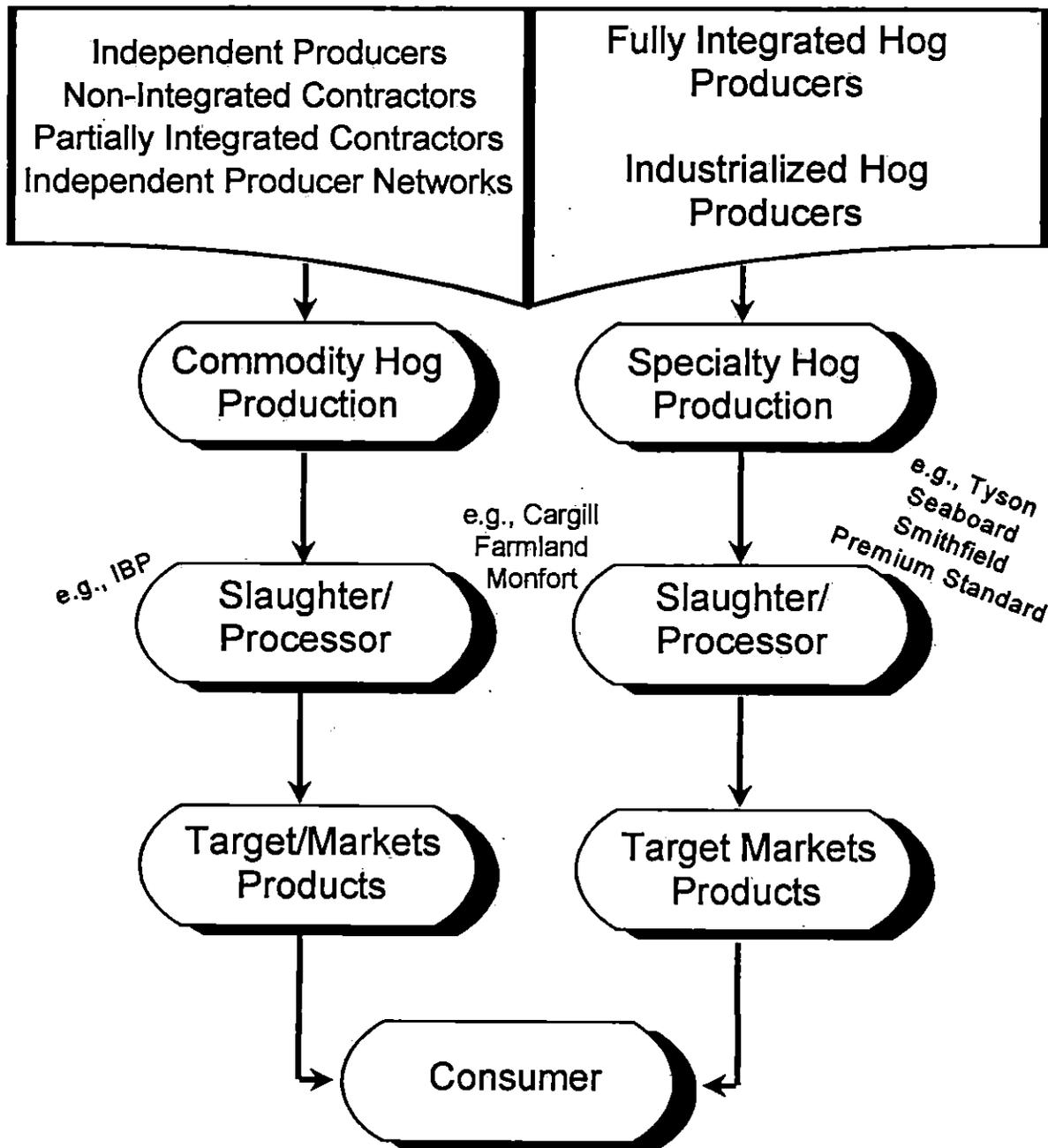
PART II

THE BIFURCATED PRODUCTION AND MARKETING CHANNEL

The hog production and marketing channel has been irrevocably changed as a result of the entry of the industrialized producers and the integrated processors. The producer centered monolithic channel of the past is being supplanted and new relationships are being forged among levels. A bifurcated channel is developing with a specialty hog side dominated by the industrialized producers with packing and processing facilities and a commodity hog side dominated by independent producers and a few large production contractors without packing and processing facilities. At this time, the commodity hog channel still has the vast majority of the volume and most of that volume is sold through the spot market transactions between independent producers and packers just prior to slaughter. Only a very modest amount of cash forward contracting occurs, where the producer retains title to the product but contracts for delivery (at some point during the production period) to a packer. The open spot market remains dominant with the majority of commodity channel volume priced in the market at the time the

Figure 3

The Bifurcated Pork Channel



hogs are delivered for slaughter.

The specialized side of the channel is different in that a significant amount of volume is owned or controlled by a corporation throughout the production and marketing process. This internally owned volume varies from all (or nearly all) of the hogs produced and slaughtered by a firm to cases where less than half the hogs slaughtered are internally owned. In most cases, however, the objective of firms operating on the specialized side of the channel leans toward direct ownership or contractual control of a very high percentage of the production and marketing activities. The span of control extends from the acquisition of the breeding animals to the marketing of final meat product in systems such as Smithfield, Tyson, Seaboard, or Premium Standard would also fall into this general category.

There are trends on both sides of the bifurcated channel toward cost reduction and increased efficiency as well as providing a higher quality of product for consumers. The two sides of the channel are attempting to generate two distinct kinds of values however. As they seek to create value, both sides of the channel will continue to create significant changes at the production level. Neither side will leave the production system of the past unaffected.

The commodity side of the channel is more likely to pursue "packer values" which translate into lower cost and better quality commodity meat output for sale at the wholesale level. These "packer values" include (1) greater uniformity in the size and shape of animals in order to permit less sorting of animals or carcass components and in some cases increased automation of slaughter activities (2) a greater consistency in meat characteristics (3) greater leanness and yield (4) more predictable flow of live animals to the plant. Optimizing shift flow, daily plant flow or even seasonal flow is important to packers. This will improve use of labor and reduce fixed facilities costs. (5) higher health standards including factors such as proper drug withdrawal

Figure 4

COMMODITY SIDE

**VALUES TO COMMODITY PACKERS
(PLANT EFFICIENCY AND WHOLESALE MARKET QUALITY)**

- 1. UNIFORMITY IN SIZE AND SHAPE OF ANIMAL**
 - LESS SORTING
 - AUTOMATION
- 2. REASONABLE LEVEL OF CONSISTENCY IN MEAT CHARACTERISTICS**
- 3. GREATER LEANNESS AND YIELD**
- 4. PREDICTABLE FLOW OF RAW PRODUCT**
 - SHIFT FLOW
 - DAILY PLANT FLOW
 - SEASONAL PLANT FLOW
- 5. HIGH HEALTH STANDARDS**
 - WITHDRAWAL
 - INJECTION SITES
- 6. LOWER TRANSACTION COSTS**
- 7. LOW STRESS DELIVERY OF ANIMALS**
- 8. RELIABLE FEEDBACK MECHANISM TO PRODUCERS DELIVERING HOGS**
 - FAVORABLE CHARACTERISTICS AND PERFORMANCE
 - PROBLEMS AND FAILURE TO PERFORM

times, proper injection sites and fewer diseased or injured animals (6) lower transaction costs in the procurement and delivery of live animals (7) low stress delivery of animals (8) improved feedback mechanisms to producers about favorable characteristics or performance as well as problems or failure to perform. (Figure 4)

The integrated and industrialized side of the channel by its nature will be in a position to generate most or all of the packer values discussed above. Beyond that it will also be in a position to pursue "consumer values" such as (1) product consistency (2) leaner product (3) more specific meat texture and flavor (4) uniformity in the shape and size of retail cuts (5) meat that is adapted or suited to specific markets for food products (6) wholesomeness and safety (7) nutritional content (8) visual appearance. (Figure 5)

The entry of fully integrated or industrialized systems is creating changes in both sides of the pork channel. The commodity side of the channel is being forced to make adjustments as the emerging fully integrated or industrialized side continues to develop and grow. Several changes in practices are now occurring on both sides of the channel. These include: genetics, channel relationships, procurement practices, pricing and payments, production emphasis, slaughter emphasis and market emphasis. (Figure 6)

CHANNEL RELATIONSHIPS

The commodity side and the industrialized sides of the dual pork production and marketing channel are exhibiting very different channel relationships than have existed in the traditional channel of past. The industrialized side of the channel by definition involves very tight coordination and direct control throughout the channel. Coordination and control on this side of the channel is enforced through either contract specification or through outright ownership.

Figure 5

**FULLY INTEGRATED/INDUSTRIALIZED
(SPECIALTY) SIDE**

**VALUES TO CONSUMERS
(PRICE AND QUALITY OF PRODUCT)**

- 1. CONSISTENCY AND PREDICTABILITY**
- 2. LEANNESS**
- 3. TEXTURE AND FLAVOR OF MEAT**
- 4. UNIFORM SIZE OF PORTION/SHAPE OF CUTS**
- 5. ADAPTED TO SPECIFIC FOOD PRODUCTS**
- 6. WHOLESOMENESS**
- 7. NUTRITIONAL CONTENT**
- 8. VISUAL APPEARANCE**

Figure 6

**KEY FACTORS IN THE EMERGING DUAL
PORK PRODUCTION AND MARKETING CHANNEL**

- 1. GENETICS USED**
- 2. CHANNEL RELATIONSHIPS**
- 3. PROCUREMENT SOURCES**
- 4. PRICING (PAYMENTS) FROM THE PACKER**
- 5. PRODUCTION LEVEL EMPHASIS**
- 6. SLAUGHTER LEVEL EMPHASIS**
- 7. MARKET EMPHASIS**

Virtually all inputs production, activities and slaughter are brought under one management system.

The commodity side of the channel preserves more of the traditional channel relationships among input supplies, producers, slaughterers, and processors than the industrialized. Despite this fact even the commodity side of the new bifurcated channel is becoming more coordinated than in the past. Non-integrated contractors proscribe uniform production practices among their contract producers and employ common genetics. Some contractors have integrated backward and own feed mills which they operate as a cost center. At this point, the coordination is aimed more toward generating packer values than final consumer values. Coordination is enforced using less formal means such as price premiums and discounts offered to producers from individual packers. While there are some common factors which are rewarded or discouraged, coordination between producer and the packer is not usually tight. Furthermore there is a great deal of variation between packers in the factors they choose to reward and the level of price premiums or discounts they place on any given factor.

The commodity side continues to produce commodity end products, but the range of acceptable variation in both live animals and the end products is being noticeably narrowed. The movement of animals to market is becoming more standardized, a larger number of production and health practices are being influenced and finally transaction costs are being more accurately apportioned to producers. Control mechanisms on the commodity side (price premiums and discounts and selective rejection) are less formal than those on the integrated industrialized side but they are nonetheless creating changes in production practices. This represents a fundamental change in the traditional channel relationships between packers and producers.

PROCUREMENT SOURCES

Procurement of livestock on the industrialized side of the channel is accomplished primarily through production contracts for company owned pigs or through production in facilities that are internally owned and operated by employees. In a few cases, production using company genetics and pigs may be done by either a non-integrated production contractor or a partially integrated contractor using the contractor's network of producers. Networks of independent producers could also be used. However in such cases, the input specification and production processes are rigidly defined by the integrated or industrialized firm.

The primary procurement source on the commodity side is still the independent producer. However a growing fraction of the volume is now being supplied by non-integrated production contractors who purchase (or contract for) inputs on the open market and do not own packing facilities. Partially integrated contractors (who own feed mills as well as livestock) are also a growing source of hogs on the commodity side. Producer networks that coordinate marketing genetics and health practices, also serve as a source of animals for the commodity hog side of the market. These networks are usually coordinated around some entity such as a veterinarian or feed supplier.

GENETICS

The industrialized integrated side of the channel is adopting very specialized genetics. Genetics are selected not only for meat quality, but also for their suitability to specific production practices and facilities and at their ability to deliver low per unit production costs. It is conceivable that in the future genetics may be selected for specific meat characteristics such as flavor, texture or suitability for processing into highly differentiated food products. But at the

present time, genetics selected by the industrialized side appear to be aimed primarily toward uniformity and production efficiency.

In contrast, the commodity side of the channel continues to handle animals with more varied genetics. Nevertheless, there has been a measurable move toward discouraging some types of genetics by some packers. There is anecdotal evidence of some lots being rejected upon delivery or the producer being told to deliver future loads elsewhere.

Perhaps more significant is the move toward a pricing system that more effectively rewards lean high yielding carcasses with minimal backfat and punishes poor carcass quality. The market news price report shown in figure 7 provides an example of how commodity packers have responded to the need for improved genetics and quality. A base packer-style carcass of 170-191 lbs. is priced (with head off) and departures from the base are priced based on percent lean and carcass weight.

PRICING FROM THE PACKER

Packer pricing on the fully integrated or industrialized side of the channel is done mostly through fixed payment production contracts with contract growers. There may be a few long term agreements with partially integrated or non integrated production contractors with strict performance criteria attached. In a few cases there may be similar agreements with producer networks.

Pricing on the commodity side of the channel remains open market with some cash forward contracting. Once again while open market pricing prevails, the use of pricing as an informal means of coordination has resulted in a wider range of premiums and discounts related to the sellers ability to provide the desired packer values.

Figure 7

Eastern Cormbelt Direct Hog Trade
 Hot Carcass Value Information
 Based on Individual Packers Plant Delivered Prices
 Lean Value Buying Programs & Weight Differentials

Estimated Deliveries ----> 12,100

Hog Carcass Value STEADY TO MOSTLY 1.00 LOWER

Weights	Percent Lean									
	41-42	43-44	45-46	47-48	49-50	51-52	53-54	55-56	57-58	59-60
	-5.00	-5.00	-3.00	0.84	0.00	1.40	2.50	3.50	3.92	3.92
	-3.25	-1.63	-0.58	0.00	1.25	2.44	3.86	4.88	6.00	7.00

Carcass Wt

140-154

-17.00	34.50	34.50	35.50	37.50	39.20	40.60	41.72	42.84	43.12	43.12
- 8.00	43.39	43.75	45.30	46.00	47.25	48.25	49.25	50.50	51.75	53.00

-----t

155-162

-4.88	46.10	47.73	48.78	49.36	50.50	51.75	52.75	53.00	53.50	54.00
-2.00	48.50	49.75	51.30	52.00	53.25	54.25	55.25	56.50	57.75	59.00

Carcass Wt

163-169

-1.08	49.90	51.50	52.50	53.16	54.00	55.25	55.93	56.50	57.00	57.50
0.00	51.50	52.36	53.48	54.60	55.44	56.84	57.96	59.08	59.75	61.00

Lean Value*****

Carcass Wt

170-191

0.00	49.50	50.50	52.00	54.00	54.50	56.25	57.02	58.50	59.12	59.12
0.00	51.80	52.92	54.04	55.16	56.00	57.50	59.50	59.64	60.50	61.50

Lean Value*****

Carcass Wt

192-199

-0.41	49.25	51.25	53.25	54.00	55.03	56.25	56.61	58.50	58.52	58.52
0.00	51.80	52.92	54.25	57.25	57.25	59.25	61.25	61.25	61.25	61.25

Carcass Wt

200-207

-1.00	48.50	50.50	52.80	53.38	54.58	55.82	56.15	58.26	58.26	58.26
0.00	51.80	52.92	54.04	56.50	56.50	58.50	60.50	60.50	60.50	61.00

Carcass Wt

208-222

-0.75	48.00	49.56	50.68	51.53	52.64	53.97	54.31	56.28	56.41	56.41
-3.36	49.75	52.00	56.00	58.00	58.00	60.00	60.00	60.00	60.00	60.20

Backfat at

10th Rib

Inches

Milimeters

More Than 1.4"	Less Than 1.4"	Less Than 1.25"	Less Than 1.15"	Less Than 1.0"	Less Than .9"	Less Than .75"	Less Than .6"	----->		
36mm	36mm	32mm	30mm	26mm	23mm	20mm	15mm			

Backfat in

Tenths at

<----	1.35	1.35	1.25	1.15	1.00	.85	.70	----->		
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SUMMARY

PRODUCTION LEVEL EMPHASIS

Emphasis at the production level on the industrialized/integrated side of the channel is currently focused on production efficiency and per unit cost of production. There is also a second emphasis on quality and consistency in the meat products produced. The potential exists for emphasis on special meat characteristics as well, but it is not a major factor at this time.

The production level emphasis on the commodity side of the channel is currently focused on gaining production efficiency. A secondary emphasis is placed on improving management and producing "high quality" commodity animals which will receive price premiums or at least not be discounted. Commodity side producers are also concerned about gaining sufficient volume to obtain price premiums from packers. The partially integrated contract producers are attempting to reduce production costs by internalizing feed production as a cost center in some cases. Finally, both the integrated and non integrated contractors are adopting the large scale three site production technologies used by the fully integrated or industrialized systems.

SLAUGHTER AND PROCESSING LEVEL EMPHASIS

The primary slaughter emphasis on the fully integrated/industrialized side of the channel is now processing efficiency. However the potential exists for shifting the efficiency emphasis toward generating brand margins from specialized products in the future. Direct control over genetics, feeding programs, health programs and other production factors could be used to develop identifiable differentiated consumer level products. At this time, these potentials remain unrealized, however. Although there are currently some product development efforts on this side of the channel these are not a major emphasis at this time.

On the commodity side of the channel, slaughter level emphasis is heavily focused on processing efficiency and cost control. Obtaining the volume of animals required to operate plants at (or near) the minimum average cost point remains an important goal for most commodity packers. High yield reasonably uniform animals are important in reaching the goal of marketing a high quality commodity pork competitively.

MARKET EMPHASIS

The market level emphasis on the industrialized side of the channel is currently focused on selling both commodity and differentiated meats. Some firms are selling differentiated branded products such as hams, bacon, cold convenience meats. Some have (or are now in the process of developing) branded nonfrozen shelf products and hot processed products such as TV dinners. Most are capable of providing consistent high quality meat product to specialty contract buyers with very stringent and narrow quality specifications.

The potential for providing differentiated branded products is not fully developed at the present time. However, as the fully integrated or industrialized firms get slaughter and processing facilities properly designed and operating efficiently, their ability to expand branded product activities is more likely to be exercised. The major impediment at that point will be consumer demand and willingness to pay for specialized products.

The market emphasis on the commodity side of the channel is currently aimed toward providing quality wholesale meat products. This side of the channel now provides the majority of wholesale meat volume to independent processors, institutional buyers and commodity oriented contract buyers. It is the principal source of undifferentiated fresh meat case products at the retail food distribution level. These markets tend to be more price conscious and have less rigid quality

specifications. They account for a large fraction of total meat sales and are likely to be important ones for at least the next decade.

PART III

FUTURE PRODUCTION MODELS

The dual channel by no means static. As stated above the fully industrialized integrated side is now attempting to consolidate a low cost position at the production, slaughter and in some cases the processing level. Marketing opportunities for specialized end products are as yet largely unrealized, but they remain a potential source of further competitive advantage for firms on this side of the channel. The efforts in the commodity channel to increase packer efficiency and quality of commodity meat are creating greater (but less formal) coordination between the input level, the production level, and the slaughter level. A variety of producers now coexist in the commodity channel including small independent producers, large independent producers, non-integrated production contractors (i.e., production contractors who have partially integrated backward) and networks of independent producers.

There is a great deal of concern about the future viability of the various types of producers in the commodity channel - especially the independent producers. The cost data and results of studies are somewhat confusing and seem to carry a conflicting message about the relationships between size and the per unit cost of production. Much of the confusion arises from differences in accounting practices, inventory measurements and the type of data used. Nevertheless, widely varying results are leading researchers to disagree on the industry direction. For example, Good et al. using a budgeting approach to compare the costs of a 3500 sow operation in the midwest to

units with 650 sows and 250 sows. Budgeted costs for the 3,500 sow unit were estimated to be \$35.94/cwt. compared to \$37.80/cwt. for a 650 sow operation and \$40.22/cwt. for a 250 sow operation. This would imply that the 650 sow operation might be cost competitive with a 3500 sow operation operated by a partially integrated or non-integrated production contractor. Presumably smaller operations would be somewhat less cost competitive with a disadvantage of \$4-5.00/cwt. or more than \$10.00 per head produced.

In contrast, Duffy has shown that using actual farm records from two independent sources (Swine enterprise records and Iowa Farm Business Mgt. Association records) that average costs do not fall significantly beyond about 150 sows. He cites swine enterprise records from 1992, 1993 and 1994. He shows average production cost for the top third of the responding producers to be approximately \$36.00/cwt. in all years and the average size of top third operations to be approximately 120 sows.

To further confuse the issue, Bruns et al. in a six year study using the swine enterprise records showed that there was remarkable variation in performance by individuals reporting into the system from year to year. Of 40 producers tracked over a six year period, 73% were among the lowest 1/3 in total production cost per cwt. in at least one of the six years. However, only 25% of the producers were in the lowest 1/3 in total production cost for four years or more. Hardly any of the producers (only 3%) were in the low cost 1/3 for all six years. Similar patterns were found for most other efficiency measures studied. This brings into question the presumption that one segment of the independent producer sector consistently outperforms the rest and attains unit cost levels competitive with the production contractors delivering to the commodity side of the channel.

It is generally agreed that the issue of production cost will play a significant role in the

future of the commodity hog side of pork industry. But the different studies lead to quite different conclusions. If the Duffy interpretation of existing cross sectional data is accurate, small to modest sized independent producers can continue to produce competitively for the commodity hog side of the channel. In that event, it will be possible for independent farmers to coexist side-by-side with non-integrated contract producers on sound economic footing. Although the partially integrated producer (operating feed manufacturing as a cost center) may gain some cost advantage, there would be little need for radical change by the independent producer.

If the budgeted cost data from Good et al. is accurate, a much different picture emerges. Smaller independent producers with less than 650 sows will be at a significant cost disadvantage. Independent producers will be forced to make heavier investments in production facilities in order to be cost competitive with the non-integrated and partially integrated production contractors. Alternatively, they will be forced into "networks" with other producers in order to match the per unit costs of the production contractors operating on the commodity side of the channel.

The Duffy findings indicate that a significant portion of independent producers are now cost competitive at an average size of 120 sows. This implies that these producers are capable of competing with their current complement of fixed assets and labor. It is reasonable to expect that they would be viable for 5-7 years. These producers appear to be able to compete at least in the short run. But there is evidence that at least some of these producers may encounter difficulty reinvesting when their present facilities are no longer suitable for use. Work by Shaffer shows that investment per breeding female is very low and quite variable among those contributing to swine enterprise records. This may reduce their current average cost below the cost levels that would exist after facilities are renovated and/or replaced. Higher depreciation costs after replacement could place them at a cost disadvantage.

Because cost studies are inconsistent, current cost of production may not be the best indicator of the future structure of the industry. In the final analysis, investment in facilities may actually provide a better indication of how future commodity side production will occur than either cross sectional or the budgeted cost estimates. The part of the industry investing most heavily in production assets is likely to have the largest share of production in the future. The vast majority of the new investment in production facilities over the past four years has been made by non-integrated and partially integrated production contractors. The unwillingness or inability of the independent producer sector to reinvest in production assets will (over time) reduce their position in the industry. This may be more a reflection of the absence of technologies within the financial reach of individual producers rather than a lack of interest or competence in hog production. But the net result will be to steadily shift a larger and larger fraction of production away from the small and medium sized independent producers to production contractors and larger scale independent producers.

The heavy capital investment requirements for the larger scale operations, place the independent producer (particularly the beginning producer) in a difficult situation. Greater amounts of capital (which is usually in short supply) is being substituted for operator and family labor which is more abundant. Lower capital requirement approaches to production in the commodity side of the channel would be desirable. The establishment of producer networks using "Segregated Early Wean" (SEW) and three site production holds some promise. This approach would permit more labor intensive farrowing to take place in existing facilities on individual farms. The pigs (SEW) farrowed would be moved to a common nursery at 2 weeks of age then on to finishers at a third site after seven weeks in the nursery. While this approach may use less capital, it requires that producers organize networks and work together. In the process some

decisionmaking sovereignty must be given up by individual producers. This is likely to make the establishment of producer networks a difficult and somewhat slow process but not an impossibility.

SUMMARY AND CONCLUSIONS

The production and marketing channel is now bifurcated. There is an industrialized fully integrated side capable of producing very specialized pork products for specific end uses. There is also a commodity side with traditional producers and production contractors providing hogs. Most production now moves through the commodity side of the channel. There is increased coordination on the commodity side, although it is of the more informal kind.

At present, independent producers are supplying the majority of the volume through the commodity side of the channel and this is not expected to change precipitously. Non-integrated and partially integrated production contractors have been steadily increasing their share of the total marketing however. There is a serious question as to whether independent producers can co-exist along side the larger scale production contractors in the future. Cost data from different sources provide a conflicting message. The revealed investment behavior of independent producers indicates that the production contractors are making larger investments in new production facilities. They will account for an increasing fraction of commodity production in the future if these trends continue and the slower rate of investment in the independent sector persists. Networks of individual producers can be formed to better utilize the existing assets and labor of independent producers to help overcome any production cost disadvantages to the traditional production technology and size of operation. Under those circumstances, this kind of model may be the only viable alternative for producers with limited access to capital and limited ability to

process of forming networks will be somewhat difficult and will require conscious effort on the part of producers but shows a great deal of promise.

- Bennink, Duane, "In Hogs Bigger Is Not Necessarily Better," Iowa Farm Business Association Newsletter, Ames, Iowa, June 1994.
- Bruns, Mark, John Kliebenstein, John Lawrence and Emmett Stevermer, "Iowa Swine Enterprise Return and Production Variability," ASL-R971, 1992 Swine Research Report, Iowa State University, Cooperative Extension Service, December 1992.
- Duffy, Michael, "Profitability in Farming: Today and Tomorrow," presented at Leopold Center for Sustainable Agriculture 5th Annual Conference, Iowa State University, March 3, 1995.
- Ginder, Roger G., "Changing Structure of the Pork Industry," Staff Paper, Iowa State University, Department of Economics, 1991.
- Good, Keith, Chris Hurt, Ken Koster, John Kadlec, and Kelly Zering, "Comparative Costs of Hog Production in the Midwest and North Carolina," presented at the Pork Global Competitiveness Seminar, St. Louis, Missouri, January 9, 1995.
- Iowa State University Extension Service, "Iowa Livestock Enterprise Summaries," Iowa State University, Cooperative Extension, EJS-206, ASB; 1992, 1993, 1994.
- Shaffer, John, "Critical Success Factors for Iowa Swine Producers," Creative Component, ISU Staff Paper, June 1995.