PRODUCTION SYSTEMS

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pork industry handbook

COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

Pork Production Systems with Business Analyses Determining Capital Requirements

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Where to Start in Determining Capital Requirements

Table 1 presents the approximate non-land costs for starting up each of eight common hog systems. These figures are a starting point to give you an idea of the investment requirements for pork production.

For instance, the table shows that it takes about $1,510 for each productive sow in the breeding herd to establish a modern farrow-to-finish enterprise on an existing farm. Assuming 15 market hogs annually from each sow unit, investment per pig produced per year would be $101 ($1,510÷15).

However, the data in Table 1 are based on assumptions that may be vastly different from your situation. For example, building and equipment costs shown assume starting the hog enterprise from "scratch" on bare land. But this is rarely the case. Typically, a producer already has some components of a production plant. Therefore, the cost of "getting started" usually involves acquisition, replacement or repair of selected items, rather than construction or purchase of a complete set of facilities.

Costs of buildings, equipment and breeding stock can also vary significantly from one producer to another, because of differences in their bargaining power and/or ability to perform contracting and building functions. Also, prices vary widely from one location to another and from one time to another.

Capital Requirements for Buildings and Equipment

In developing your own cost estimate for buildings and equipment, you need to determine two things: (1) how many animals must be accommodated at the time of peak demand, and how much space needs to be allotted to each; and (2) what is the per animal or per square foot cost for the facilities you want to provide?

Determining Number of Animals at Peak Demand

Usually, specialized buildings are used to house swine during each phase of the life cycle (e.g., farrowing, nursery, growing, etc.). Since the length of each phase differs, efficient building utilization calls for both buildings of different capacities and the practice of multiple farrowing. Although the periods will vary from operator to operator, it is rather commonly accepted that a pig developing from birth to market requires housing in a farrowing unit for 4 or 5 weeks, in a nursery unit for 4 or 5 weeks, and in a growing-finishing unit for approximately 17 weeks. Following are some rules-of-thumb for determining number of animals to be housed in the various kinds of quarters, and an explanation of each rule.

Farrowing Quarters. Rule: Determine the number of sows that will be farrowed in the "busiest" 8 weeks (most intensive farrowing period), and provide farrowing space for that number.

For disease control, many producers plan for 1 week between farrowings when the farrowing house is depopulated and cleaned. A typical farrowing period is 3 weeks from the time the first litter is born until the last. If 4 weeks is set as the minimum age at which a litter will be removed from the farrowing quarters, this means an 8-week commitment for each group of sows (including the 1-week cleaning period).

A producer can go to 6 equally spaced uses of the farrowing house per year without running into scheduling problems. At this use level, he needs to supply 1 farrowing space (approximately 35 sq. ft.) for each 3 sows in the breeding herd. (Or to say it another way, 1 farrowing house can service 3 groups of sows.)

Table 1. Approximate Capital Requirements per Unit of Production for Start-Up of Various Swine Enterprises.

Production system	Buildings a/	Equipment a/	Start-up expenses b/	Total investment
A. Sow herd enterprises		per sow unit c/		
1. Feeder pig production operations				
a. Low-investment system	$ 165	$ 185	$ 235	$ 580
b. High-investment system	300	360	235	895
2. Farrow-to-finish operations				
a. One-litter pasture system d/	$ ------	$ 285	$ 305	$ 590
b. Two-litter pasture system	225	540	580	1345
c. Low-investment confinement system	300	330	480	1110
d. High-investment confinement system	475	610	425	1510
B. Feeder pig finishing enterprises		per 100 purchased pigs c/		
a. Low-investment system	$1160	$ 825	$2050	$4035
b. High-investment system	1950	1250	2100	5300

a/ Estimated 1975 new cost per unit of production, assuming the following size of operation and facility use intensity: *for feeder pig production*—36 sows and 6 farrowings/yr. with low-investment, 150 sows and 6 farrowings/yr. with high-investment; *for farrow-to-finish*—60 gilts and 1 farrowing/yr. with one-litter pasture, 25 sows and 2 farrowings/yr. with two-litter pasture, 50 sows and 4 farrowings/yr. with low-investment confinement, 150 sows and 6 farrowings/yr. with high-investment confinement; *for feeder pig finishing*—3 groups/yr. fed in a set of facilities with low- or high-investment. For a detailed listing of buildings and equipment required, see the facilities investment tables in the Fact Sheets in this series dealing with specific systems.

b/ Represents greatest negative cash flow in a start-up situation and includes cost of breeding stock for sow herd enterprises or cost of young pigs for feeder pig finishing enterprises. See the cash-flow projection tables in the various "system" Fact Sheets.

c/ The *sow* is the unit of production for sow herd enterprise data; it denotes a mature female in production and includes a "supporting cast" of boars, replacement gilts and progeny in various stages of growth, with 14-16 market hogs sold yearly per sow unit. The unit for feeder pig finishing enterprise data is *100 purchased pigs;* it assumes feeders are fed on a continuous basis, and for each 100 pigs fed out per year, only about 1/3 are on hand at any one time.

d/ Unlike other sow herd enterprises, the cycle here is 12 rather than 6 months, with the breeding herd made up entirely of gilts farrowing once a year in spring or early summer.

Some producers make more than 6 uses of a farrowing space per year; but this requires some concessions. They must (1) reduce the 3-week interval between the first and last farrowing by either controlling estrus or providing more than one house, (2) sacrifice the depopulation and clean-up period, and/or (3) move some pigs out of the farrowing space at less than 4 weeks of age.

Nursery Quarters. Rule: Provide space for the number of pigs produced in the busiest 7 weeks of farrowing.

The nursery (which typically houses pigs between 15 and 50 lb.) can serve as an "accordion" or "safety valve" in the production system—i.e., it can be used to ease the pressure on either the farrowing or finishing houses. A good nursery building can, when necessary, accommodate pigs as young as 2 weeks of age (2 sq. ft. per pig) or as big as 100 lb. (4 sq. ft. per pig). For this reason, when expanding the enterprise, it is often wise to build or enlarge the nursery building first.

At low production intensities (farrowing 2 or 4 times yearly), a nursery is difficult to justify. Therefore, the farrowing quarters should be designed to handle pigs until they are big enough to go directly to the growing-finishing unit.

Growing-Finishing Quarters: Rule: Provide space for the number of pigs produced in the busiest 15 weeks of farrowing.

Space needs of growing-finishing animals increase as they grow. The average pig probably enters the growing-finishing facility at age 9 weeks and weighs about 40 lb. He should reach 100 lb. at 15 weeks of age, 150 lb. at 20 weeks and 220 lb. at about 27 weeks. In an environmentally controlled growing-finishing facility, that pig needs 4 sq. ft. of space for 6 weeks, then 6 sq. ft. for 5 weeks, and finally, 8 sq. ft. for 7 weeks in growing to 220 lb.

Table 2. Scheduled Farrowings During a Year for Seven Common Farrowing Systems.

System (times/yr.)	Month farrowing											
	J	F	M	A	M	J	J	A	S	O	N	D
2X			X						X			
4X			X			X			X			X
4X grouped		X				X		X				X
6X	X		X		X		X		X		X	
6X grouped	X	X	X				X	X	X			
8X*	X		X		X		X		X		X	
12X	X	X	X	X	X	X	X	X	X	X	X	X

*6-week schedule.

Some building systems allow for adjustment of floor space as the pigs grow; some do not. For instance, an off-center alley in a fully slatted finishing building makes it easy to change space allowances while avoiding the mixing of strange animals. In contrast, a pen in an open-front or dry-lot system usually receives the number of pigs that will be finished in it.

If your building system lets you adjust square footage as the pigs grow, reduce your estimate of the required size of the growing-finishing unit accordingly.

Breeding-Gestation Quarters. Rule: if you do not have some sows in farrowing or nursery quarters at all times, then you must supply a space for each sow you plan to keep.

Need for sow herd accommodations is independent of the farrowing schedule. Usually, there must be building space for each sow in the herd—15-20 sq. ft. if in

Table 3. Building Capacities and Space Requirements for a 12-Sow Swine Herd Under Various Farrowing Systems.

Item	Farrowing system							Our example (4X gr.)	Your figures [a]
	2X	4X	4X grouped	6X	6X grouped	8X	12X		
Sow/pig groups and numbers									
Total number of sows	12	12	12	12	12	12	12	*50*	
Number of sow groups	1	2	2	3	3	4	6	*2*	
Number of sows/group	12	6	6	4	4	3	2	*25*	
Avg. pigs weaned/litter	8	8	8	8	8	8	8	*8*	
Pigs weaned/sow group	96	48	48	32	32	24	16	*200*	
Farrowing facilities									
Farrowing spaces needed [b]	12	6	6	4	4	3	2	*20*	
Nursery facilities									
Pig number and weight [c]	[d]	48(85#) [d]	48(140#) [e]	32(40#)	32(140#) [e]	24(40#)	16 (40#)	*200(140#)*	
Total space needed [f]		192 ft.^{2}	288 ft.^{2} [e]	96 ft.^{2}	192 ft.^{2} [e]	72 ft.^{2}	48 ft.^{2}		
Finishing facilities									
Pig number and weight [c]	96(220#)	48(220#)	48(220#)	32(220#)	32(220#)	24(220#)	16(220#)	*200(220#)*	
				32(140#)	32(180#)	24(170#)	16(180#)		
						24(110#)	16(140#)		
							16(100#)		
Total space needed [f]	768 ft.^{2}	384 ft.^{2}	384 ft.^{2}	448 ft.^{2}	512 ft.^{2}	528 ft.^{2}	468 ft.^{2}		
Breeding and gestation facilities									
Sow spaces needed [g]	12	12	12	12	12	12	10	*50*	

a/ The figures in this table are *minimum* capacity and space requirements for a 12-sow herd. To determine the minimum requirements for your herd size, multiply each building capacity figure in the appropriate farrowing-system column by your desired number of sows, and divide by 12. Remember that the table makes no adjustment for conception rate (figures are for 12 sows farrowed), death loss after weaning (zero death loss assumed) or litter size (figured at eight pigs weaned per litter). If you expect pigs weaned per litter to be more or less than this, adjust space requirements for the nursery and finishing facilities; multiply the figures given by your anticipated pigs per litter and divide by 8.

b/ A producer can get by with less capacity if he makes one or more of the following concessions; (1) move pigs from the farrowing house at less than 4 weeks old, (2) give up depopulation and clean-up between farrowings, and (3) reduce interval between the time the first and last sows farrow by having more than one farrowing house.

c/ This is the number and average weight of pigs needing accommodations at the time of greatest demand for this facility. If you can't adjust pen size as pigs grow, allow enough space for this many animals at the per-pig design requirements for the building of your choice.

d/ A separate nursery is not justified with 2X farrowing and difficult to justify with 4X farrowing. With these schedules, consider a farrowing house designed to accommodate pigs to 50 lbs., at which size they can go directly to finishing quarters.

e/ For crop farmers, 4X grouped and 6X grouped farrowing schedules bunch farrowings to avoid conflict with planting and harvest. A consequence is that the nursery must be designed to accommodate pigs weighing up to 140 lbs., thus the 6 sq. ft. per animal space requirement.

f/ These figures are based on space requirements adjusted to pig size as discussed in the paragraphs on nursery and growing-finishing quarters on page 2. They represent an estimate of *minimum* square footage of confinement building space required for the various farrowing schedules.

g/ Does not include space requirements for replacement females and for boars as discussed on page 3.

confinement. Three circumstances, however, would reduce the need for gestation quarters to below herd size: (1) foregoing farrowing house depopulation and clean-up between farrowings, (2) using more than one farrowing house, or (3) using a sow and pig nursery.

Quarters for Replacement Gilts. Housing over and above that already discussed must be provided for female breeding herd candidates for approximately 2 months from the time they leave the market hog pen until they enter the breeding pen. Under typical farm situations, occupancy rate of such quarters will not be high—perhaps 2-6 months per year. Because of this low rate, and because they require little in the way of special care, replacement gilts are usually given the most outmoded facilities available. Most farmers already have some facilities that can perform this function.

Quarters for Boars. Rule: Provide quarters for enough boars to insure adequate "boar power" in the busiest breeding season and to avoid inbreeding.

Boars require essentially the same type of housing as gestating females but a little more space per animal (20-25 sq. ft. under roof). If replacement females come from within the herd, to avoid inbreeding, you must be prepared to house two sets of boars—a mature set to service sows, and a younger set to service gilts and older daughters of the mature boars.

Determining Facility Needs and Costs

Since sow herd enterprises require specialized buildings, a major concern of the operator is to provide adequate but not unnecessary facilities. In order to

Table 4. Approximate Per-Animal Investment for Various Types of Swine Facilities.

Type of facility	Investment per unit of production[a] Building only[b]	Building plus usual equipment[c]
Farrowing facilities	**per sow**	
Farrowing hut, no floor[d] (1 litter system)	$ 65	$ 235 (incl. fencing)
Individual sow house[d]	150	205
With slotted porch[d]	360	400
Central farrowing house		
Solid floor, crates	300	425
Slotted floor, crates	835	1100
Nursery facilities	**per 40-lb. pig**	
Open-shelter on drylot	$ 21	$ 34
Enclosed, total slotted[e]	34 ($10/sq. ft.)	40 ($12/sq. ft)
Growing-finishing facilities	**per 200-lb. hog**	
Portable house on pasture	$ 24	$ 49 (incl. fencing)
Open-shelter on drylot	28	44
Open-shelter, partial slotted[e]	64 ($8/sq. ft.)	72 ($9/sq. ft.)
Enclosed, total slotted[e]	72 ($9/sq. ft.)	88 ($11/sq. ft.)
Breeding herd facilities	**per sow**	
Portable house on pasture	$ 45	$ 60
Open-shelter on drylot	55	70
Fully-roofed, partial slotted	140	165
Enclosed, total slotted	170	240

[a] Average "turn key" prices in 1975; materials costs are approximately half of these figures.
[b] Includes manure storage for those systems where a manure tank is an integral part of the building; also includes plumbing and wiring.
[c] Includes pen partitions, feeders, fountains, fans and control, but does not include bulk feed storage, manure handling or feed processing equipment (see Tables 5, 6 and 7).
[d] These facilities usually serve more than one stage of the life cycle. For instance, a floorless farrowing hut is all that is needed throughout the year with a one-litter system; while the hut itself costs only about $65, the investment jumps to $235 when fence, feeder, fountain and shade are combined with it. Individual sow houses usually serve for both farrowing and nursery.
[e] Construction costs per sq. ft. are given in parentheses for buildings where a producer is likely to vary floor space allowance depending on size of the pigs.

determine what is adequate (and what is unnecessary), a producer should start with the farrowing schedule.

Table 2 shows monthly farrowing activity for 7 common farrowing schedules ranked by level of intensity, and Table 3 estimates the building requirements for a 12-sow herd under each of these schedules. (These requirements were arrived at by using the rules-of-thumb just discussed.)

In the last column of Table 3, calculate the various building space needs for your particular farrowing schedule and sow herd size. Then use Tables 4-7 as "price lists" to arrive at your building and equipment cost estimates. Enter these figures in column 1 of Table 11, which will be discussed later.

Table 4 gives approximate costs per unit of production (sow, 40 lb. pig or 200 lb. hog) for farrowing, nursery, growing-finishing and sow maintenance buildings. The table footnotes spell out clearly what is or is not included in these estimates. Tables 5-7 provide cost data on certain improvements and items of equipment needed for the different systems of hog production. Include those which would be important to your operation.

The figures in Tables 4-7 represent 1975 commercial price quotations in the Midwest. We strongly urge you to use them only as guidelines and to get specific quotes from local contractors or dealers.

The next to last column of Table 3 presents the building requirements for a 50-sow, low-intensity farrow-to-finish example. Facilities include: a 20-sow central farrowing house, a 25-litter sow and pig nursery, a 200-hog exposed slab, open-front finishing unit, 6 portable sow shelters on dirt lots for 50 breeding females (not including replacements), *plus* feed handling, manure handling and miscellaneous equipment. (With "4X grouped" farrowing, the farrowing house is not tightly scheduled. We assumed, therefore, that a 20-crate unit would accommodate 25 sows by moving the first-to-farrow to our sow and pig nursery. The nursery unit was designed to serve double duty as a growing building for about 4 months of the year, hence the 140-lb. maximum weight per pig in the nursery.)

Capital Requirements for Breeding Stock

To arrive at the cost of breeding stock, the following guidelines are provided for estimating the number of animals you'll need and the price you'll have to pay for them.

Determining Number of Breeding Animals Needed

Gilts. If replacement females are to come from your own herd, the penalty for having too many is modest, so you may want to hold off making final selection until just before breeding. Save 7 gilts for each 5 that you hope to force into a 3-week farrowing period. If your farrowing schedule is

Table 5. Estimated Cost of Equipment for Feed Processing, Handling and Storage (Ingredients and Finished Feed).

Item	1975 best estimate of cost
Dry grain storage	
Round steel bins (incl. foundation, erection labor and aeration)	
4,000-8,000 bu. capacity	$0.80/bu.
10,000-15,000 bu. capacity	0.70/bu.
20,000-25,000 bu. capacity	0.60/bu.
Round metal storage system with conveyers and dryer	1.00-1.25/bu.
High-moisture grain storage	
Glass-lined silo, installed (incl. base materials, unloading equipment)	
8,000 bu. capacity	$2.00/bu.
12,000 bu. capacity	1.80/bu.
18,000 bu. capacity	1.50/bu.
Soybean meal or supplement storage	
Center drawer, hopper bottom bin, erected (12-25 ton capacity)	$1100 + $35/ton over 12 tons
Feed processing and handling equipment	
Soybean roasting unit, installed	$6000
Portable grinder-mixer (3 ton)	4000
Stationary roller mill (18-in. pto)	2500
Stationary hammer mill (18-in. pto)	1250
Stationary burr mill (12-in. pto)	1600
Vertical feed mixer (1 ton capacity)	2000
Pre-mixer (250 lb. capacity)	1000
Weigh buggy	420
Electric meter-type feed mill (3 hp)	2550
Electric meter-type feed mill (5 hp)	3800
Auger wagon (3 ton capacity)	1400
Pneumatic feed delivery system	3200 + $1/ft. delivery tube
Package feed center, installed (incl. 20-40 ton overhead storage, elevator and mill)	$14,000
Finished feed storage	
Center drawer, hopper bottom bin, erected (3-9 ton capacity)	$750 + $25/ton over 3 tons

Table 6. Estimated Cost of Equipment for Manure Handling, Storage and Disposal.

Item	1975 best estimate of cost
Front end loader	
One-way cylinder, manual trip	$ 750
Two-way pressure, hydraulic dump	1400
Dry manure spreader	
95-bu. capacity	$1000
140-bu. with hydraulic endgate	1350
350-bu. capacity	3900
Liquid swine manure spreader	
1500-gal vacuum tank	$4100
2100-gal. vacuum tank	5600
Sprinkler waste irrigation system	
For combined manure and runoff:	
Two-stage lagoon	$4000
Single-stage lagoon	5000
For covered manure storage (no runoff water added)	6500
Liquid manure storage structures	
5-ft. deep earthen lagoon	$0.03/cu. ft.
Above-ground silo	0.75/cu. ft.
Under-floor pit	0.85/cu. ft.
Liquid manure aeration devices (not including installation)	
Rotor type (paddle wheel) aerator	$250/ft. OR
Farrowing capacity	20.00/sow-litter
Nursery capacity	3.74/head
Finishing or gestation capacity	11.11/head
Propeller type aerator (3 hp)	$1300/unit OR
Farrowing capacity	17.00/sow-litter
Nursery capacity	3.20/head
Finishing or gestation capacity	9.50/head
Floating type aerator (2 hp)	$1600/unit OR
Farrowing capacity	13.00/sow-litter
Nursery capacity	2.45/head
Finishing or gestation capacity	7.20/head

more relaxed (6-week breeding period) and/or if you are dealing with more carefully selected purchased replacements, plan on 6 gilts for each 5 that are to farrow.

Boars. Some rules for determining boar numbers are: 1 boar for every 15 sows with a 42-day breeding period, 1 boar for10 sows with a 21-day period, and 1 for every 5 with a 7- to 10-day period. As further insurance against being short on boar power, consider buying an extra boar for every 5 boars.

Determining Source and Price of Breeding Animals

Gilts. If expanding an existing hog enterprise, replacement females will likely come from the producer's own herd. In this case, an appropriate estimate of price would be their "opportunity value" (price at which they might have been sold as market animals). If establishing a new enterprise or if the home-raised females were genetically inferior or diseased, gilts would probably be purchased.

Table 7. Estimated Cost of Miscellaneous Items of Equipment Used in Swine Production.

Item	1975 best estimate of cost
Pressure sprayer (700 psi)	$ 800
Steam cleaner	400
Pig incinerator	950
Holding and sorting crate	300
Scales (500 lb. capacity)	300
Portable loading chute	450
Hydraulic livestock trailer	1800
Pregnancy detector	1665
Stand-by generator with hook-up (30 kw)	2000
Power failure alarm system	400
Wells	1000-2000
Access roadways (stone)	$6/lin. ft.

Replacement gilts are usually bought at around 6½ months of age (2 months younger than breeding age). They are available from purebred breeders, swine breeding companies and commercial producers. Many gilts from purebred breeders are sold at auction, whereas those from breeding companies and commercial producers are usually sold privately.

In private treaty sales, price is generally based on current slaughter hog market prices. Since commercial producers have little extra expense in raising and selling gilts for breeding, they are often willing to sell for market value *plus* a premium of $10-20 per head (for sorting and loading). Swine breeding companies, whose primary business is breeding stock production, selection and merchandising, will require a bigger premium, as Table 8 illustrates.

"Guaranteed" replacement gilts from sources that carry on comprehensive testing programs are sometimes formula-priced at approximately 4 times the per-hundredweight price of market hogs. For instance, if the top market hog price is $30 per cwt., good quality replacement gilts would be $120 apiece ($30 × 4).

Boars. Boars are available primarily from purebred breeders and swine breeding companies. Purebred boars are sold either privately or at auction, whereas boars from breeding companies are only sold privately.

Boars from breeding companies are usually priced between $250 and $500, depending on quality, reputation of the seller, health standards and guarantee. Those sold to commercial producers by purebred breeders are priced similarly.

In our example 50-sow enterprise, we needed to buy 4 boars and 70 gilts. We purchased the boars from a purebred breeder for $300 each, and the gilts from a commercial producer for $90 each (34¢/lb. market value at 220 lb. *plus* $15/head premium). Enter your estimate of breeding stock cost in column 1 of Table 11.

Table 8. Example Prices for 6½-Month-Old Open Breeding Females.

Source of replacements	Price when market hog price is: $30/cwt.	$40/cwt.	$50/cwt
Company A	$132	$152	$172
Company B	136	158	180
Company C	111	133	155
Company D	186	206	226
Commercial producer	91	113	135

Table 9. "Greatest Negative Cash Flow" Projections in a Start-Up Situation for Six Example Pork Production Systems.*

Production system	Unit of production	Greatest negative cash flow in start-up
Farrow-to-finish	Sow unit	
One-litter pasture		$ 165
Two-litter pasture		435
Four-litter confinement		330
Six-litter confinement		280
Feeder pig production	Sow unit	$ 85
Feeder pig finishing	100 pigs/yr.	$2100

*Corn priced at $2/bu.; other inputs at 1975 price estimates. Does not include cash flow to obtain breeding stock, buildings and other capital items, but does include value of purchased pigs for finishing enterprises.

Table 10. Estimated Acreage Required for Disposal of Manure per 1000 Pigs Sold from Various Swine Production Systems and Applied to Various Types of Cropland.[a]

Waste handling system and application method	Farrow-to-finish				Producing feeder pigs				Feeding purchased pigs			
	Corn	Wheat	Grass	Soy-beans	Corn	Wheat	Grass	Soy-beans	Corn	Wheat	Grass	Soy-beans
	acres per 1000 pigs sold											
Manure pit[b]												
Knifed	39	50	28	34	15	19	11	13	24	30	17	21
Broadcast	31	40	22	28	12	15	8	11	19	24	13	17
Open lot[c]												
Scraped manure:												
Broadcast and cultivated	28	36	20	25	11	14	8	9	18	22	12	16
Broadcast	23	29	16	20	9	11	6	8	14	18	10	12
Runoff[d]												
Irrigated	7	9	5	6	3	3	2	2	4	6	3	4
Lagoon[e]												
Irrigated	11	14	8	10	5	6	4	4	8	10	5	7

[a] Based on (1) amount of manure N produced by each swine production system per 1000 pigs sold (including sows where appropriate) and (2) amount of N required per acre to produce 100 bu. corn, 60 bu. wheat, 40 bu. soybeans and grass pasture that includes bluegrass and coastal Burmuda grass. Data adjusted for average N losses due to the different waste handling and application methods.

[b] Deep anaerobic pit in a typical warm confinement building.

[c] Disposal area includes acreage for scraped manure *plus* acreage for runoff from feedlot.

[d] Runoff collected in an earthen pond.

[e] All manure and dilution water in an anaerobic lagoon system; acreage may need to be adjusted, depending on soil infiltration rate.

Greatest Negative Cash Flow during 'Start-up'

The need for money to buy land, buildings, equipment and breeding stock is obvious. More difficult to foresee, however, are the outflows from a cash-flow account as the business "gets on track," i.e., as a normal inventory of feed and market animals is being established. When expanding an existing enterprise or starting a new one, money has to be available to pay for feed, medication, power, etc., until the first "payday" (when there are market hogs or feeder pigs to sell).

Other Fact Sheets present cash-flow projections in example start-up situations for the major pork production systems. Table 9 in this publication records the "greatest negative cash flow" incurred in each of several systems. To estimate greatest negative cash flow for your proposed new or expanded operation, you can either develop your own cash-flow projection using the most appropriate of the "systems" Fact Sheets as a guide, or multiply the appropriate figure in Table 9 of this publication by the number of production units you will have. Enter the answer in column I of Table 11.

For our example, greatest negative cash flow is shown in Table 9 to be $330 per sow for a 4-litter system times 50 sows or $16,500! This is the deepest our manager "goes in the hole" before he can expect receipts to start catching up with expenses.

Another aspect of negative cash flow in a start-up situation which is important to you (and your banker) is its duration. To start up, *farrow-to-finish production* typically requires a year from the time breeding stock is acquired until the first market animals are ready for sale (i.e., 2 months to take gilts to breeding age, 4 months for gestation, and 6 months from birth to market for slaughter animals). *Feeder pig production* takes 8-9 months from purchase of breeding stock until pigs can be sold (i.e., 2 months to take gilts to breeding age, 4 months gestation and 2½ months from birth to feeder size). *Feeding of purchased pigs* takes 4 or 5 months.

Is your credit supplier ready to provide the necessary funds for start-up? And is he willing to develop a payback schedule that will wait for your payday?

Capital Requirements for Land

Number of acres needed for hog production depends on the system chosen, the plan for waste disposal, and how the feed is obtained (purchased or produced). Many who consider entering or enlarging the hog business already own the needed land; thus, their land investment estimate for Table 11 will be *zero*.

However, for those who need to buy land, following are 3 alternative methods to estimate acreage needs. Choose the one most appropriate for you, determine acres required and enter your dollar investment figure in column 1 of Table 11.

Land for Pasture

If planning to produce hogs on pasture, how much land will you need? Commonly accepted stocking rates are: 8 gestating sows per acre, 5 sows with litters per acre, and 20-30 growing-finishing pigs per acre. These rates vary according to soil type, soil fertility and pasture quality. Sanitation and the maintenance of productive pastures require the manager to provide enough land for pasture rotation.

With a 3-year rotation at the above stocking rates, total acreage needed for a pasture-producing rotation is:

- Farrow-to-finish—1.1 acres per sow unit.
- Feeder pig production—0.6 acre per sow unit.
- Finishing purchased pigs—9 acres for each 100 head per group to be fed on pasture.

Example. In a 2-litter pasture farrow-to-finish system, a 25-sow herd farrowing in February and August would need approximately 28 acres of rotation cropland (25 × 1.1), a third of which would be pastured each year.

Land for Waste Disposal

The building site for fully confined hog production requires very little land. And some highly intensive units have been built on small acreages. However, the owners of these units must either: (1) gain access to land for manure disposal, by leasing manure spreading rights, for instance; or (2) build and operate expensive waste treatment facilities.

Table 11. Economic Feasibility Worksheet for Determining Total Investment and Debt Servicing Requirements.

	Total cost		To be paid from current reserves		Loans and debt servicing: Net to be financed		Interest rate		Life of loan		Annual payment to amortize loan	
Item	Our example	Your figures	Our example	Your figures	Our example	Your figures	Our example	Your figures	Our example	Your figures	Our example	Your figures
	Col. I		Col. II		Col. III		Col. IV		Col. V		Col. VI	
Buildings	$15,000		$ 0		$15,000		9%		7 yrs.		$ 2,981	
Equipment	16,500		0		16,500		9%		5 yrs.		4,243	
Breeding stock	7,500		0		7,500		9%		3 yrs.		2,963	
Greatest negative cash flow	16,500		$10,000		6,500		10%		2 yrs.		3,745	
Land	0		0		0		----		----		0	
Totals	$55,500		$10,000		$45,500		XXX	XXX	XXX	XXX	$13,932	
										Monthly loan payment	$ 1,161	

*Our example is a 50-sow low-investment, low-intensity confinement farrow-to-finish system, described in PIH-14.

Swine manure is only a modest asset to crop farmers, but it can be a major liability to producers who have no place to spread it! New technology and changing price levels may ultimately make it economically feasible to recycle wastes through the feed supply or for methane generation. But until then, a prospective confinement hog operator had better have land for waste disposal.

Table 10 provides an estimate of the amount of land required for manure disposal with various swine production systems and is expressed as acres per 1,000 pigs marketed per year. These data are based on estimated nitrogen production from all hogs (including sows) and the nitrogen required for selected crops.

Example. How many acres would be needed for manure disposal for a confinement farrow-to-finish operation marketing 2,500 hogs per year and assuming the manure is stored in a pit and broadcast on corn land that yields 100 bushels per acre? Table 10 shows that, for the conditions described, 31 acres are needed per 1,000 hogs sold, or 77.5 acres for the total operation (31 acres × 2.5 thousand market hogs).

A buffer between a hog production plant and the neighbors is extremely important. If such a buffer must be purchased, the acreage required may make investment capital needs prohibitive. Therefore, in choosing a site for production, carefully consider prevailing wind direction and location of neighboring residences, public buildings and highways.

Land For Feed Grain Production

Balancing feed grain production with usage may also be the basis for estimating acreage requirements. A hog unit on a significant acreage of productive land has two advantages. First, the business has two profit centers (crop production and livestock production) and is, therefore, less risky. Second, there is some cost advantage from feeding grain on the farm where it is grown—usually the savings of shipping and handling costs. In areas where feed grain is produced in volume and moves freely in commercial channels, this advantage will be about 10 cents per bushel corn equivalent.

Many hog producers, therefore, try to plan a business where feed grain production and utilization are roughly in balance. Approximate feed grain requirements (expressed as bushels of corn equivalent) for various types of pork production are:

- Farrow-to-finish—200 bu. per sow unit.
- Feeder pig production—60 bu. per sow unit.
- Finishing purchased pigs—1,000 bu. per 100 purchased pigs.

Example. How many acres of grain-producing land would be needed to balance feed consumption of a 500-head capacity building for finishing purchased pigs? Assuming a 4-month feeding period, 3 groups (1,500 head) will be fed annually. Therefore, enough land is needed to produce 15,000 bu. of corn equivalent (15 units of 100 pigs × 1,000 bu). That's 150 acres of 100-bu. corn land, for instance.

Determining the 'Economic Feasibility' of a Proposed Hog System

The feasibility of a new or expanded swine operation (i.e., can this plan be put into action?) depends on your answer to two sets of questions: (1) what would be my total cost, and do I have or can I get the money?; and (2) what would be my debt load, and can I handle it? The danger is that a producer might either initiate his plan without sufficient cash reserves, or agree to an unrealistically short pay-off period on his loans.

Table 11 provides a way to test the economic feasibility of your start-up or expansion plan. Since you have already recorded your estimated "total cost" in column 1, follow these steps to complete the table:

1. Estimate what dollar portion of each cost category can be met as a "down payment" from your current reserves, and enter in column II.
2. Subtract the down payment (col. II) from total cost (col. I), and enter in column III. This is what must be financed by other sources.
3. In column IV, enter the interest rate at which money will be borrowed; and in columm V, record the period over which the loan will be retired.
4. For a given interest rate and life-of-loan, determine from Table 12 the annual loan payment per $1,000, and multiply that figure by the amount to be financed (in

Table 12. Annual Payments to Amortize $1000 Loans of Varying Life Spans and Interest Rates (Even Payment Plan Computed by the Annuity Formula).

	Annual payment per $1000 when interest rate is —						
Life of loan in years	5%	6%	7%	8%	9%	10%	10½%
2	$537.80	$545.44	$553.09	$560.77	$568.48	$576.19	$580.05
3	367.21	374.11	381.05	388.03	395.07	402.11	405.66
4	282.01	288.59	295.23	301.92	308.70	315.47	318.90
5	230.97	237.40	243.89	250.46	257.13	263.80	267.17
6	197.02	203.36	209.80	216.32	222.97	229.61	232.98
7	172.82	179.14	185.55	192.07	198.74	205.40	208.80
10	129.50	135.87	142.38	149.03	155.89	162.75	166.26
12	112.83	119.28	125.90	132.70	139.73	146.76	150.38
15	96.34	102.96	109.79	116.83	124.15	131.47	135.25
20	80.24	87.18	94.39	101.85	109.66	117.46	121.49
25	70.95	78.23	85.81	93.68	101.93	110.17	114.43
30	65.05	72.65	80.59	88.83	97.46	106.08	110.53
35	61.07	68.97	77.23	85.80	94.75	103.70	108.29
40	58.28	66.46	75.01	83.86	93.06	102.26	106.97
Never (interest only)	50.00	60.00	70.00	80.00	90.00	100.00	105.00

Example: What are the annual payments on a 10-year loan of $5400 at 6% interest? Read the 10-yr. life-of-loan line in the 6% column, then multiply the $135.87 by 5.4 (number of $1000 units), which equals $733.70 annual payment.

thousands of dollars) from column III. Enter the answer in column VI, "annual payment to amortize loan." For instance, to retire our example building investment in 7 years at 9% interest, Table 12 indicates an annual payment of $198.74 per thousand. Fifteen units of $1,000 × $198.74 equals $2,981 per year to be paid on the buildings.

5. Finally, total all the columns.

To answer question #1 concerning your ability to provide the capital required by your proposed enterprise, compare the bottom line of column II with the liquid items in your financial statement and the bottom line of column III with your borrowing capacity. For question #2 concerning your debt servicing capability, part of the answer comes from the bottom line of column VI; the rest comes from an estimate of your net cash flow and its adequacy to meet the capital needs estimated in column VI.

To complete your feasibility analysis, put your capital servicing needs (column VI) on a monthly basis, and enter them as cash expense items in your cash-flow projection. To develop a cash-flow budget, see the Fact Sheet describing the system in which you are interested.

(Note: The cost of land for the hog enterprise can be included in Table 11 along with the other capital needs. However, if the land is productive, it may generate income separate from the hog enterprise. This income should be included as a source of funds in your cash flow to complete your feasibility analysis.)

Determining the 'Profitability' of a Proposed Hog System

Would your hog enterprise, once established, be profitable? Could you compete with other producers, or would your production costs be too high? The best way to predict production costs and returns is to prepare a detailed budget, as done in each of the Fact Sheets describing the various production systems.

A major problem in preparing a budget is how to handle capital items. One way is to reduce the investment figures for buildings, equipment, breeding stock, operating inventory and land to a charge that can be levied against each feeder pig, market hog, or hundredweight (cwt) of gain. A common technique to accomplish this is to calculate the "annual ownership cost" for these investment items, then divide the results by the number of animals (or hundredweights) to be produced per year (Table 13).

Defining Annual Ownership Cost

Annual ownership cost is what you need each year to pay property taxes and insurance, to provide maintenance, to pay a competitive interest rate on the money tied up in the investment, and to set aside funds (depreciation) so that, at the end of the useful life of an item, your capital will be intact. Putting the figures on a per-sow or per-pig or per-cwt. basis (Table 14) answers the question, "How much rent must each unit of production pay for the use of these capital items?"

Table 13 is a worksheet (with example figures from our 50-sow low-investment confinement system) for estimating annual ownership charges for your particular situation. Use the data which you develop in Table 13 to prepare a production budget and to compare yourself with other producers and other production systems. Table 14 shows the annual ownership costs for various systems.

Our figures are based on new facilities at 1975 prices. For the system you are considering, if your annual ownership cost estimate is significantly higher than these, you should search for ways to reduce it. Look for opportunities to: (1) eliminate frills, (2) improve construction efficiency, (3) simplify design, and (4) produce more hogs in the same set of facilities by more efficient scheduling.

Calculating Your Annual Ownership Costs

Table 13 is completed as follows:

1. Establish your total investment for buildings, breeding stock, operating inventory and land.
2. Estimate the annual ownership charges (depreciation, interest, taxes, etc.) for these items as a percentage of the investment.
3. Add the various percentage charges for each item, and multiply by the dollar investment to arrive at annual ownership cost.
4. Divide total annual ownership cost by the number of units (sow, 100 purchased pigs, cwt. gain) to be produced yearly to arrive at ownership costs per unit.

The section that follows explains how investment estimates and various percentage charges for each item presented in Table 13 were determined.

Buildings and Equipment (A and B)

Dollar Investment. To estimate the investment in these items, you may simply use the most appropriate figures from Table 1, or you may develop your own by using the information on pages 1-4.

Percentage Ownership Charges. Building ownership charge was figured at 15.5% of investment. Allowing for lags in reassessment and with a $6 tax rate, property taxes were assumed to equal 1.5% of investment. Insurance was figured at .5% (based on an insured value of 65% and a rate of 75¢). Interest was set at 4½% (half of 9%), maintenance at 2% and depreciation at 7% (based on 15-year life).

Equipment ownership charge was figured at 21.5% of investment. Allowing for early depreciation and with a $6 tax rate, taxes were assumed to equal 1% of investment, insurance was figured at .4% (based on an insured value of 50% of cost and a rate of 75¢). Interest was set at 4½% (half of 9%), maintenance at 3.6% and depreciation at 12% of investment (based on 8-year life).

For buildings and equipment, depreciation is the biggest item in annual use cost. You must decide upon an appropriate "useful life" estimate, taking into account your management and the quality of the particular item. In our example, we used 15 years for buildings, 8 for equipment, straight-line depreciation and no salvage value. For instance, for a building with 15-year depreciable life, approximately 7% (or 1/15) of its cost is charged to each year.

Half of the going interest rate has been charged to the current investment in building or equipment items to estimate the annual interest charge in the average year of life. In reality, it is the value of the asset, not the interest rate, which is at half-value in the average year (with straight-line depreciation and no salvage). However, we get the same arithmetic effect by dividing the interest rate by 2.

Breeding Stock (C)

Dollar Investment. In our example, females came from within the herd, and boars were purchased routinely each September. Our $7,750 investment estimate is based on a boar value at the average of their buying and selling prices, and females at their market price.

Ownership Charges. Since breeding herd investment will be relatively constant, a competitive interest rate of 9% was applied to the investment and charged against the enterprise. Tax and insurance rates were assumed to be the same as for the equipment investment.

In the example, depreciation was not a big item, since home-raised replacements are not depreciated. It is a

Table 13. Potential Profitability Worksheet for Determining Annual Ownership Costs.

Item	Our example Pct.	Our example Dollars	Your figures Pct.	Your figures Dollars
A. Buildings				
Total investment		$15,000		$_____
Annual ownership charges				
Depreciation	7.0%		_____	
Interest	4.5		_____	
Maintenance	2.0		_____	
Taxes	1.5		_____	
Insurance	0.5		_____	
Total % of investment	15.5%		_____%	
Annual ownership cost		$ 2,325		$_____
B. Equipment				
Total investment		$16,500		$_____
Annual ownership charges				
Depreciation	12.0%		_____	
Interest	4.5		_____	
Maintenance	3.6		_____	
Taxes	1.0		_____	
Insurance	0.4		_____	
Total % of investment	21.5%		_____%	
Annual ownership cost		$ 3,545		$_____
C. Breeding stock				
Total investment		$ 7,750		$_____
Annual ownership charges				
Interest	9.0%		_____	
Taxes	1.0		_____	
Insurance	0.4		_____	
Total % of investment	10.4%	805	_____%	_____
Depreciation*		800		_____
Annual ownership cost		$ 1,605		$_____
D. Operating inventory				
Total investment		$12,750		$_____
Annual ownership charges				
Interest	9.0%		_____	
Taxes	1.0		_____	
Insurance	0.4		_____	
Total % of investment	10.4%		_____%	
Annual ownership cost		$ 1,325		$_____

Table 13. Continued.

E. Land				
Total investment		$ 0		$_____
Annual ownership charges				
Interest	9.0%		_____	
Maintenance	------		_____	
Taxes	1.0		_____	
Insurance	------		_____	
Total % of investment	10.0%	0	_____%	_____
"Lost opportunity" charge		0		_____
Annual ownership cost		$ 0		$_____
F. Grand totals				
Total investment		$52,000		$_____
Annual ownership cost		$ 8,800		$_____
G. Ownership cost per unit				
Size of production unit				
No. of sows *or*	50		_____ or	
No. of purchased pigs	XXX		_____	
Ownership cost/unit		$ 176.00		$_____
Expected annual production				
No. of feeder pigs *or*			_____ or	
No. of cwts. gained	1,707		_____	
Ownership cost/unit		$ 5.15		$_____

*Depreciation for breeding stock = (purchase price – selling price) ÷ years of use. For our example: ($1200 – 400) ÷ 1 = $800.

Table 14. Annual Ownership Costs per Unit of Production for Various Example Swine Enterprises.

Production system	Buildings	Equipment	Breeding stock	Operating inventory	Total ownership costs: Per sow or 100 pigs	Total ownership costs: Per pig or cwt. gain
A. Sow herd enterprises						
1. Feeder pig production operations	----------		per sow unit*	----------		per pig
a. Low-investment system	$ 25.40	$ 38.50	$24.00	$ 4.70	$ 92.60	$5.36
b. High-investment system	46.50	76.90	23.70	4.70	151.80	8.80
2. Farrow-to-finish operations						per cwt. gain
a. One-litter pasture system	$ -----	$ 60.90	$19.90	$ 8.30	$ 89.10	$5.48
b. Two-litter pasture system	35.00	116.00	27.00	26.00	204.00	5.98
c. Low-investment confinement system	46.50	70.90	32.10	26.50	176.00	5.15
d. High-investment confinement system	73.70	131.40	23.10	26.50	254.70	7.50
B. Feeder pig finishing enterprises	----------		per 100 purchased pigs*	----------		
a. Low-investment system	$180.00	$177.00	$------	$160.00	$517.00	$3.16
b. High-investment system	301.50	268.50	------	159.00	729.00	4.46

*For a definition of *sow unit* or *100 purchased pigs,* what they do or do not include, see footnote c in Table 1.

sizeable and ongoing expense only for males. Our plan involved a $1,200 expenditure for boars each year minus $400 from the sale of used boars, leaving $800 boar depreciation to be charged against the enterprise.

Record your boar depreciation expense in Table 13. And if you plan to buy replacement females, record that depreciation charge in the same manner.

"Normal" Operating Inventory (D)

The operating inventory (which includes market animals, feed and supplies) will likely vary considerably from month to month; but Table 15 shows the *average* situation. The figures are based on estimates of the market price of corn and cost of producing the market hog inventory. They are consistent with data in the Fact Sheets that describe the various production systems.

The table provides two estimates of "average inventory value"—one for a business where a year's supply of feed grain is obtained at harvest, and one for a business where the grain is purchased as it is used. As can be seen, these values differ significantly. In the one case, feed grain becomes just another input, and value of the operating inventory is tied to the number and size of animals on hand. In the other case, another major inventory item has been added, with that inventory at a maximum when the feed grain is purchased at harvest then being depleted during the feeding year.

In our example estimate in Table 13, the hog enterprise was assumed to be separate from corn storage—i.e., corn was "purchased" as needed.

To find the total operating inventory investment, multiply the appropriate figure from Table 15 (e.g., $255) by the number of animal units you are planning on (50 sows). The result ($12,750) is the investment on which annual ownership cost is figured (interest, taxes and insurance, but not depreciation or maintenance.)

Land (E)

In the example used in this publication, no land charge was made against the hog enterprise. We were not willing to sell the land which is the building site for our hog enterprise, and it has no alternative use in our business.

But your situation may be different. Therefore, you will need to determine land lost to production because of the hog business *and/or* any acreage which would be used more profitably if there were no hog enterprise.

For that land which would be taken out of production, we suggest calculating annual ownership charge at 10% of its value. Since land does not depreciate, the investment will remain intact, and, therefore, an interest charge should be made at competitive (9%) rates. The other ongoing charge would be for property taxes (1%). There may also be a small charge for liability insurance, and perhaps a maintenance cost connected with tile drains or erosion control.

For land which will be used in a less profitable manner because of the hog enterprise, first estimate the dollar "lost opportunity" for extra profit per acre, then multiply by the number of acres affected. For instance, assume you are planning a "pork factory" on land capable of producing continuous corn. Because of manure disposal needs, you calculate that 40 acres must be left out of corn and sowed to wheat each year. The "lost opportunity" is the difference in profit from 40 acres of wheat as opposed to 40 acres of corn.

Table 15. Average "Normal" Operating Inventory per Unit of Production for Various Example Swine Enterprises (Feed Grain Stored Vs. Feed Grain Purchased as Needed.)*

Production system	Unit of production	Normal operating inventory when— Feed grain stored	Grain purchased as needed
Farrow-to-finish	Sow unit		
One-litter pasture		$ 135	$ 80
Two-litter pasture		400	250
Four-litter confinement		460	255
Six-litter confinement		450	255
Feeder pig production	Sow unit	$ 80	$ 45
Feeder pig finishing	100 pigs/yr.	$2450	$1525

*Corn figured at $2/bu. and other production inputs at 1975 prices.

Where to Go from Here

Can you provide the financing for your proposed swine enterprise (Table 11)? Once established, will your planned unit have competitive production costs (Table 13 and a budget)? And will it be able to meet debt payments (Table 11 and a cash-flow projection)?

If any of these "tests" reveal that you would have problems, you should reconsider your plans. The most likely adjustments would involve: (1) reducing the size of the proposed enterprise, (2) finding others to provide a share of the capital through a cooperative or partnership arrangement, (3) choosing a different production system or different facility design (and cost), and/or (4) financing with loans of longer term and (if possible) at lower interest rates.

If, after preparing and studying these reports (Tables 11 and 13) along with a cash-flow projection and a budget, your plan still looks profitable and reasonable, then one final test should be made. Before investing any money, invest some time in visiting several pork producers who use the system you are considering. Find out what each operator likes about it, what he considers to be important to success, and what his problems are. Then check with your state Extension Service for help in planning the changes.

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