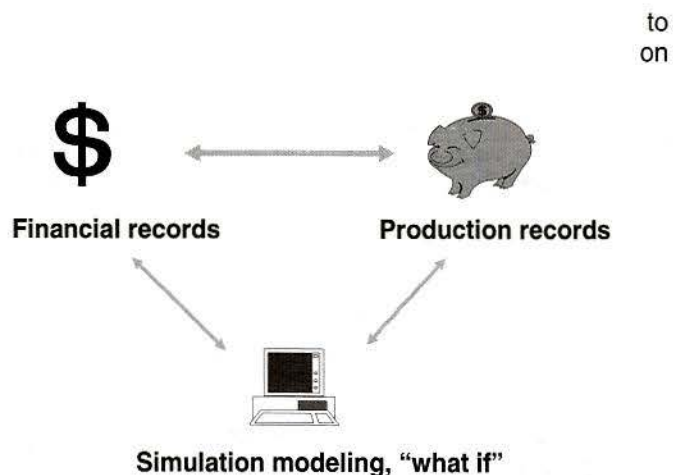


The Use of Spreadsheets In Determining Production Costs

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This paper will discuss and demonstrate a method for calculating and studying the Cost of Production (COP) in a pig production farm unit. The use of micro-computer spreadsheets allows for the creation of a mathematical model of the production and financial relationships within a farm. Once the model is established it can easily be updated and used to determine sensitivity analysis for a variety of input factors and a Breakeven Analysis can be done to calculate the market income needed for the farm unit to breakeven financially.

This spreadsheet model can be created in a 2 to 4 hour process. The time and effort depends on the complexity of the farm and the status and availability of production and financial records. The creation of a spreadsheet model is graphically demonstrated in the following diagram. Financial and Production records are used to develop or create a spreadsheet/mathematical model of the farm. The following is a discussion of the spreadsheet based approach and some examples of a farm analysis.



Pork Production Financial Analysis System

The Pork Production Financial Analysis System is a series of computer spreadsheet templates used to perform financial analysis, financial planning, simulation modeling and to provide proforma financial statements for pig production units. The computer spreadsheet models have the flexibility to simulate many different farm situations. The spreadsheets are a useful tool for calculating the cost of production, breakeven analysis and for developing budgets and projections for both new and expansion farm projects. They can be used to calculate proforma financial statements and to perform sensitivity analysis on a variety of production factors, input variables and market price situations. The models are used to help understand the economic and financial returns of a pig production enterprise.

The Cost of Production (COP) spreadsheet model will be used to demonstrate this analytic approach using case study data.

Example Farm

- 1,200 sow farrow to finish, single site operation established 8 years ago
- Mycoplasma pneumonia and PRRS +ve herd, no major clinical signs
- Marketing 28,713 finished pigs, 23.93 pigs marketed per sow per year, 2,580 kg. of live weight pig sold per sow per year
- Whole-herd feed conversion, including breeding stock feed at 3.40
- Age of pigs to average slaughter weight of 110 kg is 172 days
- There is a 10% grading premium and 79% dressing percentage
- 9.5% of the slaughter pigs are lightweight receiving 82% of full market value
- Debt is \$4,192,785 at an average interest rate of 8%; principle and interest payments are \$480,821.28 annually

Base Calculations:

To establish base financial statements, an assumption was made to use long-term, average feed grain and slaughter pig market prices. The following outlines a base financial position using a Corn input cost of \$100.00 per tonne and a Market Price of \$140.00 per 100 kg. of pig carcass (ckg.).

Input Corn cost	\$100.00 per tonne
Feed cost per pig marketed, including breeding stock feed	\$62.73
Feed cost per pig marketed, individual pig	\$55.88
Market Price used in calculations and sensitivities	\$140.00
Calculated Gross Revenue per pig sold	\$129.86
Cash balance for annual operation	\$195,405.25
Net Income Statement Profit/Loss, after Income Tax	\$129,003.87

A powerful feature of taking the time to build a spreadsheet simulation model of the farm is the ability to predict the Breakeven point for the farm and the overall Cost of Production of the slaughter pigs. A detailed Cash Statement is included as Appendix 1.

The following table outlines these values for this farm using the input costs outlined above:

Cost of Production and Breakeven Calculations on a cash basis:	
Cost of Production (COP), per pig marketed	\$125.83
Cost of Production (COP), per kg. live weight marketed	\$1.1668
Breakeven Market Price, per ckg.	\$131.07

This shows that the calculated cost of production, on a cash basis, for a market pig is \$125.83. This would require a market price of \$131.07 per ckg. of carcass weight generate enough revenue to meet all the cash payment requirements to operate the farm. Cash basis refers to the cash flow required to pay all cash requirements, including loan principle and interest payments.

Net Income refers to Revenue less Variable and Fixed Costs where fixed costs include depreciation/capital cost allowance on the buildings and facilities and interest charges on long-term debt. On a Net Income basis values are:

Cost of Production and Breakeven Calculations on a Net Income basis:	
Cost of Production (COP), per pig marketed	\$126.65
Breakeven Market Price, per ckg.	\$133.56

This analysis shows that a Market Price of \$125.83 per ckg, resulting in a gross income per slaughter pig of \$121.64, is required to generate enough cash income to pay all bills and expenses, including principle and interest. This is based on a feed grain inputs cost for corn of \$100.00 per tonne.

Sensitivity Analysis

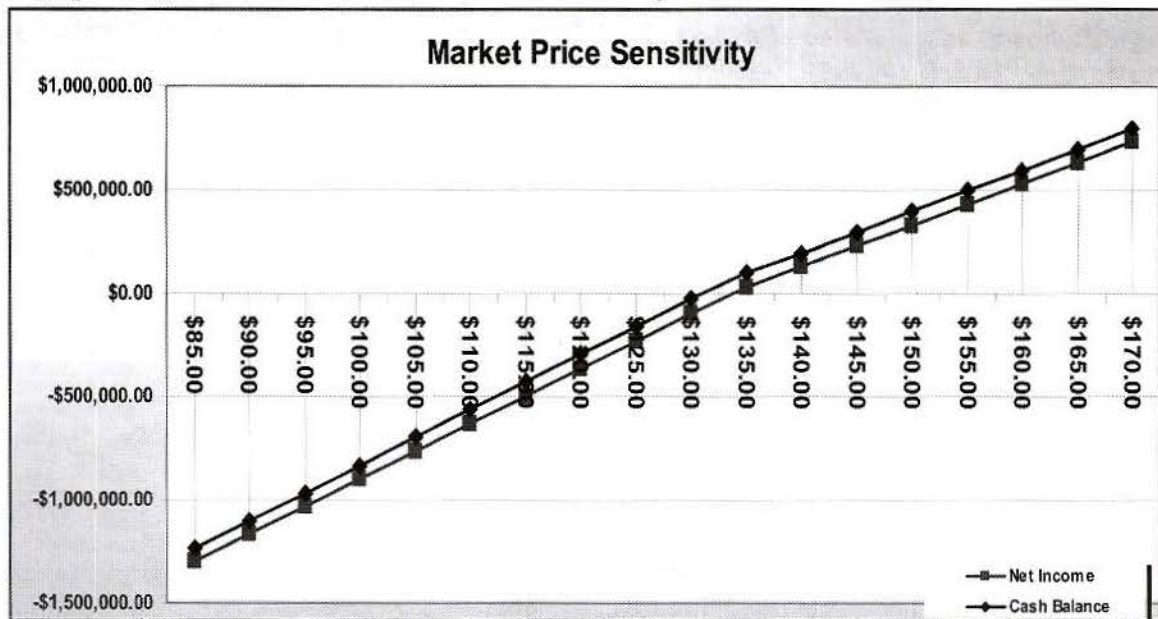
The above reflects a long-term, average situation of this farm. What happens when the hog market changes, feed grain costs increase, productivity changes, etc.? The simulation model can predict some of these changes by using the spreadsheet to create data tables.

Pig Market Price Sensitivity

The table above shows the impact of various market prices on the annual Net Income and Cash Balance. Feed costs calculated using the feed grain cost input @ \$100.00/tonne.

Market Price Sensitivity:	Net Income	Cash Balance
\$85.00	-\$1,297,045.59	-\$1,230,644.21
\$95.00	-\$1,029,945.45	-\$963,544.07
\$100.00	-\$896,395.39	-\$829,994.01
\$105.00	-\$762,845.32	-\$696,443.94
\$110.00	-\$629,295.25	-\$562,893.87
\$115.00	-\$495,745.18	-\$429,343.80
\$120.00	-\$362,195.12	-\$295,793.73
\$125.00	-\$228,645.05	-\$162,243.67
\$130.00	-\$95,094.98	-\$28,693.60
\$135.00	\$28,841.32	\$95,242.70
\$140.00	\$129,003.87	\$195,405.25
\$145.00	\$229,166.42	\$295,567.80
\$150.00	\$329,328.97	\$395,730.35
\$155.00	\$429,491.52	\$495,892.90
\$160.00	\$529,654.07	\$596,055.45
\$165.00	\$629,816.62	\$696,218.00
\$170.00	\$729,979.17	\$796,380.55

A graphic representation of Market Price Sensitivity:



Productivity Sensitivity

The table below shows the impact of changes in herd productivity based on the market @ \$140/c/kg and feed inputs @ \$100.00/tonne.

Productivity Sensitivity:	Net Income	Cash Balance
17.00	-\$315,753	-\$249,351
18.00	-\$245,346	-\$178,945
19.00	-\$174,940	-\$108,538
20.00	-\$104,533	-\$38,132
21.00	-\$34,127	\$32,275
22.00	\$27,210	\$93,611
23.00	\$80,015	\$146,416
24.00	\$132,819	\$199,221
25.00	\$185,624	\$252,026
26.00	\$238,429	\$304,830
27.00	\$291,234	\$357,635

Feed Grain Sensitivity:

The table below shows the impact of various Barley input cost using the Market Price input at \$140.00/c/kg.

Feed Grain Input Cost:	Net Income	Cash Balance
\$100.00	\$129,003.87	\$195,405.25
\$105.00	\$96,780.35	\$163,181.73
\$110.00	\$64,556.84	\$130,958.22
\$115.00	\$32,333.33	\$98,734.71
\$120.00	\$109.82	\$66,511.20
\$125.00	-\$42,818.26	\$23,583.12
\$130.00	-\$85,782.95	-\$19,381.57
\$135.00	-\$128,747.63	-\$62,346.25
\$140.00	-\$171,712.32	-\$105,310.94
\$145.00	-\$214,677.00	-\$148,275.62
\$150.00	-\$257,641.68	-\$191,240.30
\$155.00	-\$300,606.37	-\$234,204.99
\$160.00	-\$343,571.05	-\$277,169.67
\$165.00	-\$386,535.74	-\$320,134.36
\$170.00	-\$429,500.42	-\$363,099.04
\$175.00	-\$472,465.10	-\$406,063.72
\$180.00	-\$515,429.79	-\$449,028.41
\$185.00	-\$558,394.47	-\$491,993.09
\$190.00	-\$601,359.16	-\$534,957.78

An example page of a Cost of Production Summary including several graphs is attached as Appendix 2.

Feed Usage and Costs:

A detailed feed budget is attached as Appendix 3. A Feed Type and Ingredient Cost and Use chart is included as Appendix 4.

Summary

While it is difficult and time consuming to develop a good re-creation of the farm financial situation, the results can be very worthwhile. The analysis presented here provides valuable information to assist with decision making and planning. This is especially true with negotiating market price contracts and other revenue based commitments or arrangements. Once the simulation model is established it becomes relatively easy to make updates, ask additional questions and run additional scenarios. Breakeven and pay-back/return on investment analysis can be done on any number of decisions and courses of action.

This paper demonstrates:

- a methodology of doing a **Cost of Production Analysis**, and
- a methodology of doing a **Breakeven Analysis**

Another benefit of applying a consistent and in-depth analysis using the same approaches and methodology is the establishment of a benchmark database. Comparisons become possible both

with the farm at various time frames and between farms. A reliable set of Benchmarks will prove to be a great asset to the pork industry.

Disclaimer

Computer models and simulations depend completely on the accuracy and consistency of the input data used.

An old computer saying goes: "Garbage In = Garbage Out". This is very true with this type of analysis.

APPENDIX I:

Proforma Annual Cashflow:		Self Reliance & Hard Struggle Pig Farm	
		1,200 breeding sows in full production	
Livestock Revenue:	Total	Per Pig mkt.	
Finished Pigs Marketed	\$3,728,604.30	\$129.86	
Feeder Pigs Marketed	\$0.00	\$0.00	
Iso-wean Pigs Marketed	\$0.00	\$0.00	
Cull Sows Marketed	\$79,632.00	\$2.77	
Cull Boars Marketed	\$202.50	\$0.01	
TOTAL LIVESTOCK REVENUE	\$3,808,438.80	\$132.64	
Other Pig Income	\$0.00	\$0.00	
TOTAL CASH INFLOW	\$3,808,438.80	\$132.64	
CASH OUTFLOW			
Livestock Expenses:	Total	Per Pig mkt.	
Feed Costs	\$1,864,378.56	\$64.93	
Replacement Breeding Stock	\$201,750.00	\$7.03	
Salaries & Benefits	\$270,000.00	\$9.40	
Utilities Costs	\$114,853.17	\$4.00	
Vet & Drug Costs	\$133,516.80	\$4.65	
Manure handling and disposal	\$45,168.75	\$1.57	
Artificial insemination and breeding costs	\$14,580.00	\$0.51	
Management, consulting & other fees	\$66,000.00	\$2.30	
Marketing Costs	\$139,128.08	\$4.85	
General Expenses:			
Maintenance Costs	\$132,000.00	\$4.60	
Property Taxes	\$1,000.00	\$0.03	
Insurance	\$49,335.62	\$1.72	
Salary (Owner/Operator)	\$50,000.00	\$1.74	
Office and accounting expenses	\$5,000.00	\$0.17	
Contract, leasing and rental expenses	\$0.00	\$0.00	
Miscellaneous and other expenses	\$2,500.00	\$0.09	
Income Tax	\$43,001.29	\$1.50	
Mortgage Loan # 1 (P & I)	\$480,821.28	\$16.75	
Mortgage Loan # 2 or other loan (P & I)	\$0.00	\$0.00	
Mortgage Loan # 3 or other loan (P & I)	\$0.00	\$0.00	
Mortgage Loan # 4 or other loan (P & I)	\$0.00	\$0.00	
Mortgage Loan # 5 or other loan (P & I)	\$0.00	\$0.00	
Debenture/Subordinated Debt (P & I)	\$0.00	\$0.00	
TOTAL CASH OUTFLOW	\$3,613,033.55	\$125.83	
Surplus (Deficit) For Period	\$195,405.25	\$6.81	
Operating Loan (Beg. Period)	\$0.00	\$0.00	
Net Cash Balance	\$195,405.25	\$6.81	
Interest on Operating	\$0.00	\$0.00	
Cash Balance	\$195,405.25	\$6.81	

APPENDIX 2:

Cost of Production and Financial Summary

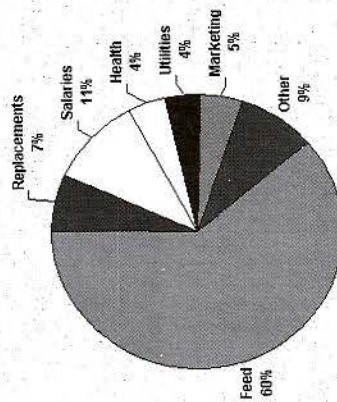
Self Reliance & Hard Struggle Pig Farm	
Number of breeding sows in herd	1,200
Number of pigs marketed	28,713
Herd Productivity, pigs marketed per sow per year	23.93
Kilograms of live weight pig sold per sow	2,580
Feed cost per pig marketed, including breeding stock feed	\$62.73
Feed cost per pig marketed, individual pig	\$55.88
Whole herd live weight feed conversion	3.40
Age to Market for Slaughter Pig, days	172.00
Market Price used in calculations and sensitivities	\$140.00
Calculated Gross Revenue per pig sold	\$129.96
Cash balance for annual operation	\$195,405.25
Net Income Statement Profit/Loss, after Income Tax	\$129,003.87

Cost of Production and Breakeven Calculations:

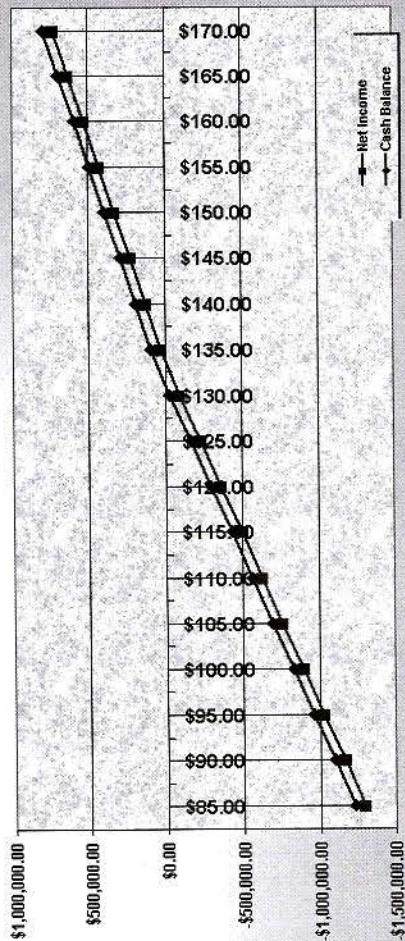
Cash Basis:	
Cost of Production (COP), per pig marketed	\$125.83
Cost of Production (COP), per kg live weight marketed	\$1.1668
Breakeven Market Price, per ckg.	\$131.07
Net Income Basis:	
Cost of Production (COP), per pig marketed	\$126.65
Cost of Production (COP), per kg live weight marketed	\$1.1744
Breakeven Market Price, per ckg.	\$133.56

Return on Equity	6.15%
Return on Assets	5.57%

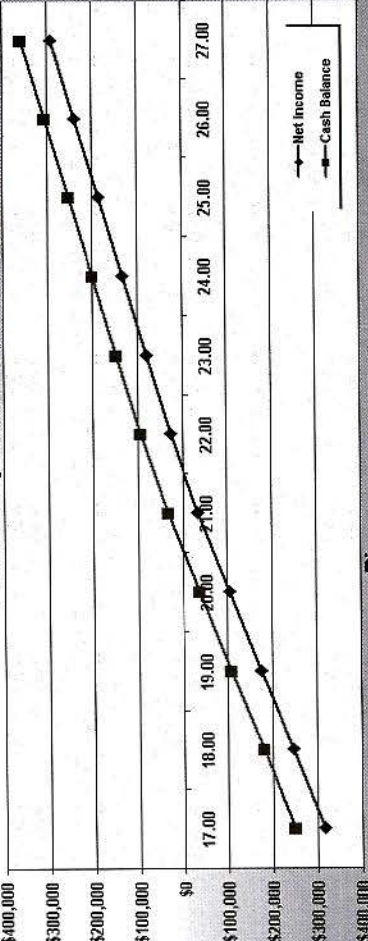
Variable Costs



Market Price Sensitivity

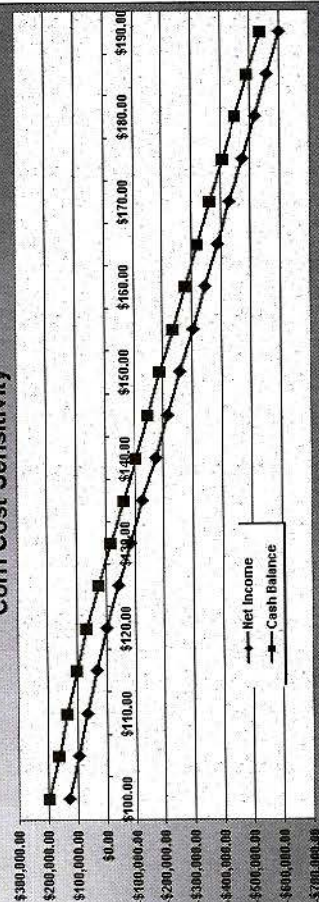


Productivity Sensitivity



Pig per sow per year

Corn Cost Sensitivity



Corn cost per tonne

APPENDIX 3:

Feed Budgets and Summary		Self Reliance & Hard Struggle Pig Farm	
	kg./pig	Costs/pig	
Feed cost of pigs sold as iso-wean pigs:	-	\$0.00	
Nursery Feeding & pigs sold as feeder:	kg./pig	Costs/pig	
Pre-starter/creep	1.80	\$2.25	
Starter #1	3.38	\$1.10	
Starter #2	20.00	\$3.89	
Pre-grower Feed	19.50	\$4.01	
Totals for Individual Feeder Pig:	44.68	\$11.25	
Total for Feeder Pig adjusted for death loss:	45.13	\$11.36	
Weaning weight into nursery	6.50	kg.	
Weight out of nursery/sold as feeders	28.00	kg.	
Nursery pig average daily gain (ADG) in gms	448.96	gms.	
Nursery pig feed conversion	2.08		
Days in Nursery	48.00		
Age out of Nursery	69.00		
Slaughter pigs:	kg./pig	Costs/pig	
Pre-grower Feed	6.00	\$1.23	
Grower #1 Feed	26.95	\$4.66	
Grower #2 Feed	31.20	\$5.30	
Grower #3 Feed	30.72	\$4.95	
Finisher #1 Feed	69.36	\$10.92	
Finisher #2 Feed	70.38	\$10.65	
Finisher #3 Feed	39.00	\$5.67	
Totals for Individual Finished Pig:	273.61	\$43.38	
Totals adjusted for the death loss per pig to market:	280.81	\$44.52	
Weight into grow/finish	28.00	kg.	
Slaughter, marketing weight	110.00	kg.	
Grow/finish Average Daily Gain (ADG)	801.46	gms.	
Days in grow/finish	103.00		
Breeding Stock:	kgs/Year	Cost/Year	
Sow Gestation Feed	692.12	\$107.37	
Sow Lactation Feeding Days	327.60	\$55.74	
Total sow feed per year	1,019.72	\$163.11	
Boars	912.50	\$141.55	
Data for individual pig sold, excluding breeding stock:			
Feed cost, adjusted for death loss	\$55.88		
Feed used, adjusted for death loss	325.94	kg	
Average Daily Gain (ADG), birth to slaughter	633.72	gms per day	
Feed conversion, birth to slaughter	2.99		
Age to slaughter weight	172.00	days	
Data for individual slaughter pig, including breeding stock:			
Feed cost, adjusted for death loss, not including replacements	\$62.73		
Feed cost, adjusted for death loss, including replacements	\$64.93		
Feed used, adjusted for death loss, including replacements	370.66	kgs.	
Feed conversion, whole herd including breeding stock	3.40		
Total feed cost for unit, annual basis	\$1,864,378.56		
Total tonnes of feed used by unit on an annual basis	10948.57	tonnes	

APPENDIX 4:

Feed Usage Chart:		Self Reliance & Hard Struggle Pig Farm			
Feed quantity per ration used:	Total kgs. per year	Kgs. per month	kgs. per week	Kgs. per day	
Pre-starter/creep	54,913.49	4576.12	1056.03	150.45	
Starter #1	102,962.79	8580.23	1980.05	282.09	
Starter #2	610,149.89	50845.82	11733.65	1671.64	
Pre-grower Feed	776,944.33	64745.36	14941.24	2128.61	
Grower #1 Feed	817,699.77	68141.65	15725.00	2240.27	
Grower #2 Feed	946,650.57	78887.55	18204.82	2593.56	
Grower #3 Feed	932,086.72	77673.89	17924.74	2553.66	
Finisher #1 Feed	2,104,477.04	175373.09	40470.71	5765.69	
Finisher #2 Feed	2,135,425.23	177952.10	41065.87	5850.48	
Finisher #3 Feed	1,183,313.21	98609.43	22756.02	3241.95	
Lactation Sow Feed	393,120.00	32760.00	7560.00	1077.04	
Dry Sow Feed	890,824.93	74235.41	17131.25	2440.62	
Totals:	10,948,567.98	912,380.66	210,549.38	29,996.08	
Feed cost per ration type:	Total \$ per year	\$ per month	\$ per week	\$ per day	
Pre-starter/creep	\$68,641.86	\$5,720.16	\$1,320.04	\$188.06	
Starter #1	\$33,427.64	\$2,785.64	\$642.84	\$91.58	
Starter #2	\$118,640.59	\$9,886.72	\$2,281.55	\$325.04	
Pre-grower Feed	\$159,817.45	\$13,318.12	\$3,073.41	\$437.86	
Grower #1 Feed	\$141,410.95	\$11,784.25	\$2,719.44	\$387.43	
Grower #2 Feed	\$160,871.43	\$13,405.95	\$3,093.68	\$440.74	
Grower #3 Feed	\$150,042.66	\$12,503.55	\$2,885.44	\$411.08	
Finisher #1 Feed	\$331,270.99	\$27,605.92	\$6,370.60	\$907.59	
Finisher #2 Feed	\$323,196.61	\$26,933.05	\$6,215.32	\$885.47	
Finisher #3 Feed	\$171,979.78	\$14,331.65	\$3,307.30	\$471.18	
Lactation Sow Feed	\$66,889.37	\$5,574.11	\$1,286.33	\$183.26	
Dry Sow Feed	\$138,189.22	\$11,515.77	\$2,657.48	\$378.60	
Totals:	\$1,864,378.56	\$155,364.88	\$35,853.43	\$5,107.89	
Ingredient Usage Chart:		Self Reliance & Hard Struggle Pig Farm			
Ingredient quantity used:	Total kgs. per year	Kgs. per month	kgs. per week	Kgs. per day	
Barley	8,592,936.82	716078.07	165248.78	23542.29	
Wheat	-	0.00	0.00	0.00	
Barley	-	0.00	0.00	0.00	
Additional feed grain # 1	-	0.00	0.00	0.00	
Additional feed grain # 2	-	0.00	0.00	0.00	
Soybean Meal	1,933,022.37	161085.20	37173.51	5295.95	
Dried whey	10,296.28	858.02	198.01	28.21	
Additional protein ingredient # 2	-	0.00	0.00	0.00	
Additional protein ingredient # 3	-	0.00	0.00	0.00	
Vitamin premix # 1	20,074.23	1672.85	386.04	55.00	
Fat/oil	-	0.00	0.00	0.00	
Sow pack	3,209.86	267.49	61.73	8.79	
Trace mineral premix	13,628.87	1135.74	262.09	37.34	
Monocalcium phosphate	148,629.34	12385.78	2858.26	407.20	
Limestone	101,677.53	8473.13	1955.34	278.57	
Spray dried blood meal	2,574.07	214.51	49.50	7.05	
Selenium premix	6,159.94	513.33	118.46	16.88	
DL-Methionine	51.48	4.29	0.99	0.14	
Copper sulfate	534.83	44.57	10.29	1.47	
Salt	39,693.34	3307.78	763.33	108.75	
Lysine	14,414.56	1201.21	277.20	39.49	
Medication #1, Nursery pigs per kg. of medication product	713.11	59.43	13.71	1.95	
Medication #2 per kg. of medication product	1,942.36	161.86	37.35	5.32	
Medication #3 per kg. of medication product	4,059.83	338.32	78.07	11.12	
Totals:	10,893,618.83	907,801.57	209,492.67	29,845.53	
Ingredient cost:	Total \$ per year	\$ per month	\$ per week	\$ per day	
Barley	\$859,293.68	\$71,607.81	\$16,524.88	\$2,354.23	
Wheat	\$0.00	\$0.00	\$0.00	\$0.00	
Barley	\$0.00	\$0.00	\$0.00	\$0.00	
Additional feed grain # 1	\$0.00	\$0.00	\$0.00	\$0.00	
Additional feed grain # 2	\$0.00	\$0.00	\$0.00	\$0.00	
Soybean Meal	\$531,581.15	\$44,298.43	\$10,222.71	\$1,456.39	
Dried whey	\$9,575.54	\$797.96	\$184.14	\$26.23	
Additional protein ingredient # 2	\$0.00	\$0.00	\$0.00	\$0.00	
Additional protein ingredient # 3	\$0.00	\$0.00	\$0.00	\$0.00	
Vitamin premix # 1	\$50,185.58	\$4,182.13	\$965.11	\$137.49	
Fat/oil	\$0.00	\$0.00	\$0.00	\$0.00	
Sow pack	\$3,209.86	\$267.49	\$61.73	\$8.79	
Trace mineral premix	\$10,221.66	\$851.80	\$196.57	\$28.00	
Monocalcium phosphate	\$74,314.67	\$6,192.89	\$1,429.13	\$203.60	
Limestone	\$0.00	\$0.00	\$0.00	\$0.00	
Spray dried blood meal	\$5,791.66	\$482.64	\$111.38	\$15.67	
Selenium premix	\$12,319.88	\$1,026.66	\$236.92	\$33.75	
DL-Methionine	\$236.81	\$19.73	\$4.55	\$0.65	
Copper sulfate	\$133.71	\$11.14	\$2.57	\$0.37	
Salt	\$3,969.33	\$330.78	\$76.33	\$10.87	
Lysine	\$43,243.69	\$3,603.64	\$831.61	\$118.48	
Medication #1, Nursery pigs per kg. of medication product	\$10,696.69	\$891.39	\$205.71	\$29.31	
Medication #2 per kg. of medication product	\$23,308.33	\$1,942.36	\$448.24	\$63.86	
Medication #3 per kg. of medication product	\$48,717.92	\$4,059.83	\$936.88	\$133.47	
Totals:	\$1,686,800.16	\$140,566.68	\$32,438.46	\$4,621.37	
Feed Manufacturing Costs	\$109,485.68	\$9,123.81	\$2,105.49	\$299.96	

The Basics of Cost of Production and Breakeven Analysis