



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

A FEASIBILITY STUDY OF CONTRACT FINISHING OF HOGS

Bill Brown

*Department of Agricultural Economics,
College of Agriculture and Bioresources,
51 Campus Drive, University of Saskatchewan, S7N 5A8
Email bill.brown@usask.ca*

Marv Painter,

*Department of Management and Marketing
College of Commerce,
University of Saskatchewan*

Mark Ferguson,

*Industry and Policy Analysis,
Sask Pork.*

Abstract

A multi year financial model was used to evaluate the economics of contract finishing of hogs. The model includes projected income statements, balance sheets, and cash flow statements, as well as the calculation of the Internal Rate of Return (IRR) using discounted after tax cash flows. The model uses contract fees and incentive schemes, and the evaluation of manure and how much of it can be captured as income. It uses depreciation on capital investment (which affects the amount of income taxes paid), interest costs on borrowed capital, labor, utilities, insurance, maintenance, property taxes, and the cost of spreading the manure as expenses. The effect of an injection of patient capital was also calculated. The calculations were done for a 20 year period, from the time the facility is built and stocked with hogs to the end of the serviceable life of the barn. The results indicate that there are at least three conditions within the barn enterprise that have to be met in order for it to become economically viable. The first condition is the life of the contract. If the barn has a serviceable life of 20 years, it must be full of pigs for all or most of that time to generate competitive rates of return. The second condition is the capture of the nutrient value of the manure. The hog owners have not been able to capture the nutrient value of the manure because they don't usually own the land surrounding their enterprises, that is to say stand alone barns have not been able to sell the manure at its full nutrient value. However, a contract feeder of hogs can locate the barn in the middle of their own land and take full advantage of the nutrient value of the manure through their cropping enterprises. The third condition is financial leverage. If the first two conditions are met and interest rates are below 8%, contract finishers of hogs can use financial leverage to their advantage. The addition of a 10% patient capital also helps the economic viability of the enterprise.

Keywords: financial model, contract finishing of hogs

Introduction

A multi year financial model was used to evaluate the economics of contract feeding of hogs. The model includes projected income statements, balance sheets, and cash flow statements, as well as the calculation of the Internal Rate of Return (IRR) using discounted after tax cash flows. The IRR is the annual percentage rate of return on the original investment of equity capital generated by the after tax cash flows from the investment over its life. The model uses contract fees and incentive schemes and the evaluation of manure and how much of it can be captured as income. It uses depreciation on capital investment

(which affects the amount of income taxes paid), interest costs on borrowed capital, labor, utilities, insurance, maintenance, property taxes, and the cost of spreading the manure as expenses. The effect of a patient capital injection (no interest and repayment over 5 years starting in year 5) is also calculated.

The calculations were done for a 20 year period, the serviceable life of the barn, from the time the facility is built and stocked with hogs. Most hog finishing contracts are for 5 years with an option to renew for another 5 years. In addition barn financing is generally done with a 10-year repayment period.

Contract Hog Finishing Income

Contract finishing of hogs usually requires the barn owner to build the barn to the general specifications of the hog owners. The hog owner supplies the hogs, the feed, veterinary expertise, treatments, and sometimes the labor as well. The barn owner is essentially renting the facility to the hog owner. The rental income or contract fee is based on the space required by a hog during the feeding period. The standard contract fee is approximately \$54.00Cdn per pig space per year. This fee is based a 25 kilogram pig coming into the barn and taking 16 weeks to finish thereby resulting in 3 batches of pigs being finished per year. The capacity of the barn is usually based on 0.69 square meters of pen space required per pig. There are also incentives for good feed conversion that can add up to another \$1.50Cdn per pig space per year.

Some hog owners prefer to supply their own labor when contracting finishing. Others allow the barn owner to supply the labor. Contracts including barn owner supplied labor are usually a little lower but include training, supervision, and a larger incentive program. These contracts usually result in almost equivalent rates of return on investment to the barn owner plus the income generated by the labor. However, these contracts also include a management clause that will allow the hog owner to take over management if animal performance is compromised.

Contract Finishing Capital Cost

The two types of hog feeding systems that will be analyzed are a 2,400 head finishing facility with an earthen manure storage (EMS) system. The unit size was chosen because this fits nicely with the weekly supply of 25 kilogram pigs being produced from 3,000 or 6,000 sow unit operations weaning about 25 pigs per year per sow. The facility is equipped with fully slatted floors and small pens.

The capital cost of the feeding facility is summarized in Table 1. It is assumed that most farm sites will have an existing water supply and exiting phone, natural gas, and power services. Given these assumptions, the total capital cost of this enterprise is \$290.47Cdn per pig space.

Table 1: Capital Cost (\$Cdn) of 2,400 Head Barn with Earthen Manure Storage

(25 m x 75 m .6 m pits, EMS) 2.5m Ceiling

Material Building Materials & Concrete	\$ 353,593
Total Labor	\$ 318,535
Development Costs	\$ 25,000
Totals	\$ 697,127
Total Cost/Pig Space	\$ 290.47

Economic Evaluation of Hog Manure

The economic evaluation of the hog manure will be based on a number of calculations. The first calculation is the amount of manure produced and the amount of land needed upon which to spread the manure. The second calculation pertains to the value of the manure. Hog operations that do not own the surrounding land cannot capture the full value of the manure because neighboring land owners are not willing to pay for the full nutrient value. However, hog operations that are associated with the owners of the surrounding land may be able to capture the value of the nutrients available to the crop or crops to be grown on the land. A final consideration is the cost of applying the manure to the land and the distance within which it should be transported.

The Amount of Manure Produced

A hog being fed from 25 kilograms to slaughter weight produces 8.5 liters of manure a day (Saskatchewan Agriculture and Food, 2006). It follows that a 2,400 head capacity hog operation will produce; $8.5 \text{ liters/day} \times 2,400 \text{ head} \times 365 \text{ days} = 7,446,000 \text{ liters per year}$. The normal rate of application is 67,373 liters per hectare. Therefore a 2,400 head hog finishing operation will need $7,446,000 \text{ liters} / 67,373 \text{ liters per hectare} = 110.5 \text{ hectares per year}$ upon which to spread the manure. Given that the manure is spread on the land once every 3 years, a total of 331.5 hectares are needed within approximately 3.3 kilometers from the barn.

The Value of the Nutrients

The value of the manure produced by the finishing enterprise needs to be measured carefully to make sure its true economic benefit is calculated correctly. The first step is to measure the value of the nutrients in a unit of manure, say one thousand liters, as if one were to buy them in the market place. The major nutrients would be nitrogen, phosphorus, potassium, and sulfur. Unfortunately not all the nitrogen and phosphorus are available to a crop in the first year. Some of the nutrients will leach out of the soils, evaporate, or may stay in an inaccessible form for so long that their value is very limited. Table 2 presents an analysis of the value of the nutrients in a typical sample of 1,000 liters of hog manure. Nutrients available to the crop in years 2 and 3 are discounted by 20% per year. The nutrient value per acre using the usual rate of 67,373 liters per hectare is $\$3.88\text{Cdn} / 1,000 \text{ liters} \times 67,373 = \$261.41\text{Cdn per hectare}$. Given the analysis in Table 2, the 2,400 head enterprise will produce $7,446,000 \text{ liters} \times \$3.88 / 1,000 \text{ liters} = \$28,890.48\text{Cdn per year}$.

Table 2: The Value (\$Cdn) of 1,000 liters of Hog Manure (Nutrients Available in Years 2 and 3 are Discounted by 20% per year)

Total Nutrients	kgs/1,000 liters	\$/kg	Usable Year #1	Fertilizer Year #2	(kgs) Year #3	Total \$
Total Nitrogen	3.09					
Ammonium N (NH₄)	1.9	\$0.99	1.90	0.00	0.00	\$1.88
Organic N	1.2	\$0.99	0.30	0.12	0.05	\$0.47
Total Phosphorus (P)	1.0	\$0.93	0.50	0.10	0.04	\$0.60
Total Potassium (K)	1.4	\$0.60	1.40	0.00	0.00	\$0.84
Total Sulfur (S)	2.0	\$0.93	0.10	0.00	0.00	\$0.09
					Total	\$3.88

Source: *Tri-Provincial Manure Application and Use Guidelines, Saskatchewan Agriculture & Food Fact Sheets, 2006*

If the hog finishing enterprise is not associated with a crop enterprise that can take advantage of the nutrients then it can only realize a return based on the willingness to pay for the manure by neighboring crop farmers. Past practice in the industry has indicated that neighboring crop farmers have been willing to pay between \$37 - \$62 Cdn per hectare. It should also be noted that not all land nor crops grown in Western Canada are able to take advantage of this level of nutrients so the value quoted above should be considered an optimistic number.

There is still an additional value calculation of the manure; that being the added value of the crop yield response to the manure application over and above what an equivalent amount of commercial fertilizer can provide. This phenomena deals with the increased crop response to the organic nature of the manure, its supply of other micro nutrients, and that about 1/4 inch of water is also being supplied. This additional value is not included in this study, though research conducted by soil scientists has established this bonus crop response to be a reality (Nagy et al. 2000).

The Cost of Applying Hog Manure

Industry standards indicate that the cost of injecting hog manure into the soil ranges from \$0.00198 - \$0.00242Cdn per liter at a rate of 67,373 liters per hectare. This works out to \$133.41 – \$163.05Cdn per hectare. Lighter rates may also be more economical to the crop on all soil types due to the limited ability of the crop to absorb all the nutrients available and translate them into higher yields for the part of the plant that is desired (Nagy et.al. 2000). If lower rates of application are preferred the costs would likely be more per liter (.0002199 per liter) as the equipment would have to be run longer and more distance would have to be covered resulting in increased fuel costs and wear on equipment..

The Effect of Hauling Distance on Cost

The proximity of the application fields to the hog finishing operation will make a difference on the cost of applying the manure. Most manure applicators interviewed said that transporting the manure more than 3.3 kilometers from the EMS site would add significant costs.

The Effect of Distance from Weanling Facilities, Feed Mills and Packing Plants

The distances that the feed for the hogs and the hogs themselves have to travel will affect the contract finishing enterprise. The hog owners have to absorb these costs and therefore will not want to contract with finishers that are isolated from their weanling facilities and feed mills and their preferred slaughter plants as these distances add to their costs. Most hog owners interviewed felt that potential contract finishers should ideally be within 50 kilometers of the feed mill and weanling facilities. Most also felt that in order for a new hub of hog production to start, the core would have to be at least 3,000 to 6,000 sows and an adequate number of finishing barns in the area (20 – 25 2,400 head finisher barns) along with a feed mill. The distance from the weanling facilities and to the slaughter plant, were not as important as the distance from the feed mill. The cost of hauling the feed and the pigs is paid by the hog owners and therefore is not included in the calculations of the costs and returns associated with the barn enterprise.

The Economics of Contract Finishing of Hogs

The assumptions used as input into the base simulation for the 2,400 head barn are summarized in Table 3. It should be noted that the manure is valued at \$37.00Cdn per hectare or \$4,089Cdn per year, labor is charged at \$15,000Cdn per year plus benefits of \$2,673Cdn and all the capital supplied is in the form of cash or equity and no money is borrowed. The labor is

charged as an expense to the barn enterprise. This gives the true rate of return on the investment without the complicating effects of debt financing and labor income

The barn is assumed to have a serviceable life of 20 years. The hog feeding contracts are assumed to be 5 years in length and renewable for another five years. At this time no hog owners are willing to commit to longer contracts. The barn owner is therefore going to have to take on the risk that the contract may not be renewed after 5 years and especially after 10 years. In addition the barn owner has to renegotiate the contract amount at each renewal. The assumption here is that the contract amount stays constant at \$54.00Cdn per pig space. If the contract is not renewed the barn owner could feed his/her own pigs in the facility, but this entails an entirely different set of risk variables and is not simulated here. The assumption here is that the barn sits empty for the remainder of its life if the contract is not renewed. However, hog owners have said that they are committed to contract finishing rather than owning their own barns because of the huge investment cost of owning all their facilities and their inability to capture the higher value of the manure.

Table 3 Assumptions of Base Simulation for 2,400 Head Barn (\$Cdn)

Long Term Debt Interest Rate	0.0%
Rate of Inflation (expenses)	2.0%
Barn Rental - First 5-year contract \$/Pig Space	\$54
Barn Rental - Second 5-year contract	\$54
Manure Sales	\$4,089
Manure Sales Rate of Growth	0.0%
Wage Laborers	1
Hourly Wage	\$15.00
Hours per worker	1,000
Utilities	\$9,000
Manure Disposal	\$16,381
Office/Barn Supplies	\$2,000
Maintenance	\$5,000
Insurance	\$5,500
Property Taxes	\$600
Payment Period	0
Percentage debt	0%
Percentage Patient Debt	0%
Long Term Debt	\$0
Patient Debt	\$0
Owner Equity	\$672,127

Table 4 presents the IRR for various contract lengths, bonuses, and valuation of manure scenarios assuming no debt. Obviously the barn owner needs to get the contract renewed for at least a second 5 year period for the investment to be viable.

In addition, the barn owner needs to strive for the bonus, but more importantly needs to take advantage of the higher valuation of the manure which is based on its nutrient value is \$28,891Cdn or \$264.41Cdn per hectare per year. It can be seen that valuing the manure at its nutrient value has a significant effect on the

results. It is also important to note that only barn owners that also own the surrounding land upon which the manure is spread can capture this benefit.. It should also be noted that the value of the manure (\$28,891Cdn) is assumed to be paid in cash from the cropping enterprise to the barn enterprise. However, this may not be necessary as long as the barn does not have any debt.

The level of the IRRs presented in Table 4 are lower than the 15 – 20% rates of return usually required on business investments with similar risks. Given the fact that the contract may not be renewed or may be renewed at a lower level contributes to the risk of the barn investment. Taking advantage of the higher manure value is also not guaranteed. Given the current low prices for cereals and oilseeds, many landowners are cutting back on fertilizer rather than increasing. In addition some land may not be suitable for large amounts of hog manure applications. Investments of similar risks should return at least 15% if not higher. It would appear that the barn enterprise will have to rely on financial leverage to realize competitive levels of IRR.

Table 4: Percentage IRR by Contract Length, Barn Rental Rate, Bonus, and High Manure Valuation, 0 Debt

	5 years	10years	15 years	20 years
Barn Rental (\$54/pig space/year)	-6.4	1.4	5.6	7.3
+ Bonus (\$1.50/pig space/year)	-6.1	2.1	6.3	8.0
+ High Nutrient Value of Manure	-4.1	6.2	10.2	11.6
+ Bonus and High Nutrient Value	-3.8	6.9	10.8	12.2

Table 5 presents the IRR resulting from various combinations of interest rates and percentage of debt capital with a 10 year repayment period on the debt. The other assumptions include the standard contract of \$54.00Cdn per pig space per year over the 20- year life of the barn, no bonuses, and selling the manure for \$37.00Cdn per hectare rather than realizing the nutrient value of the manure. Combinations of interest rates and percentage of debt resulting in at least 1 year of negative cash flows are highlighted in bold. Given current interest rates in the 6% to 8% range, the barn cannot be more that 50% debt financed. Higher percentage debt financing will result in negative cash flows in at least 1 year.

Table 5: Percentage IRR by Interest Rate and Percent Debt, 10 Year Repayment (Bold Indicates Negative Cash Flow)

Interest Rate / % Debt	10%	20%	30%	40%	50%	60%	70%	80%	90%
0%	7.8	8.3	8.9	9.6	10.5	11.7	13.2	15.6	20.1
1%	7.7	8.2	8.7	9.3	10.1	11.1	12.5	14.5	18.1
2%	7.7	8.1	8.5	9.1	9.7	10.6	11.7	13.4	16.2
3%	7.6	8.0	8.3	8.8	9.4	10.1	11.0	12.3	14.4
4%	7.6	7.8	8.2	8.5	9.0	9.5	10.2	11.2	12.7
5%	7.5	7.7	8.0	8.2	8.6	9.0	9.5	10.2	11.2
6%	7.5	7.6	7.8	7.9	8.2	8.4	8.8	9.2	9.8
7%	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.2	8.5
8%	7.3	7.3	7.4	7.4	7.4	7.3	7.3	7.3	7.3
9%	7.3	7.2	7.1	7.1	6.9	6.8	6.6	6.4	6.2
10%	7.2	7.1	6.9	6.8	6.5	6.3	6.0	5.6	5.2
11%	7.2	7.0	6.7	6.4	6.1	5.8	5.3	4.8	4.3
12%	7.1	6.8	6.5	6.1	5.7	5.2	4.7	4.1	3.4

The effect of financial leverage can also be seen in Table 5. The IRR for the 0 debt scenario is 7.3% (Table 4). When debt capital can be secured for less than 7.3% the resulting IRR is higher than 7.3%. When debt capital has to be secured for more than 7.3% the IRR eventually is lower than 7.3%. Even though high IRRs can be attained by higher percentage of debt financing at low interest rates the barn enterprise itself would not be able to cash flow these payments so other sources of cash would have to be used.

Table 6 presents the IRR resulting from various combinations of interest rates and percentage of debt capital with a 20 year repayment period on the debt. The other assumptions include the standard contract of \$54.00Cdn per pig space per year over the 20 year life of the barn, no bonuses, and selling the manure for \$37.00Cdn per hectare rather than realizing the nutrient value of the manure. Combinations of interest rates and percentage of debt resulting in at least 1 year of negative cash flows are highlighted in bold. Given current interest rates in the 6% to 8% range, the barn cannot be more than 70% to 80% debt financed. Higher percentage debt financing will result in negative cash flows in at least 1 year.

Table 6: Percentage IRR by Interest Rate and Percent Debt, 20 Year Repayment (Bold Indicates Negative Cash Flow)

Interest Rate / % Debt	10%	20%	30%	40%	50%	60%	70%	80%	90%
0%	8.0	8.9	10.0	11.4	13.3	16.1	20.6	29.1	52.3
1%	8.0	8.8	9.7	11.0	12.8	15.3	19.4	27.2	48.5
2%	7.9	8.6	9.5	10.6	12.2	14.5	18.1	25.1	44.3
3%	7.8	8.4	9.2	10.2	11.5	13.5	16.7	22.8	39.4
4%	7.7	8.2	8.8	9.7	10.8	12.5	15.1	20.3	34.2
5%	7.6	8.0	8.5	9.2	10.0	11.3	13.4	17.5	28.6
6%	7.5	7.8	8.2	8.6	9.2	10.1	11.6	14.4	22.4
7%	7.4	7.6	7.8	8.0	8.3	8.8	9.6	11.1	15.3
8%	7.3	7.4	7.4	7.4	7.4	7.4	7.3	7.2	6.8
9%	7.2	7.1	7.0	6.7	6.4	5.8	4.9	2.8	- 100
10%	7.1	6.9	6.5	6.0	5.3	4.2	2.1	- 2.8	- 100
11%	7.0	6.6	6.1	5.3	4.2	2.3	- 1.2	- 100	- 100
12%	6.9	6.4	5.6	4.5	2.9	0.3	- 100	- 100	- 100

The effect of financial leverage can also be seen in Table 6. The IRR for the 0 debt scenario is 7.3% (Table 4). When debt capital can be secured for less than 7.3% the resulting IRR is higher than 7.3%, even to the point of positive infinity at 100% debt financing. However, when debt capital has to be secured for more than 7.3% the IRR eventually drops below 7.3%, even to the point of negative infinity (speedy bankruptcy) with as little as 70% debt financing at 12% interest rates. This increased financial risk must be considered by potential barn owners when contemplating highly leveraged (debt financed) scenarios.

Table 7 presents the IRR resulting from various combinations of interest rates and percentage of debt capital with a 10 year repayment period on the debt, which is comparable to Table 5. However, in the case of Table 7 a 10% patient capital investment is added. The patient capital represents 10% of the barn investment value and is interest free and paid back in equal annual installments in years 5 to 10 of the 20 year simulation. The patient capital repayment needs to be delayed at least 3 years in order for the barn enterprise to establish itself. The other assumptions include the standard contract of \$54.00Cdn per pig space per year over the 20 year life of the barn, no bonuses, and selling the manure for \$37.00Cdn per hectare rather than realizing the nutrient value of the manure.

Table 7: Percentage IRR by Interest Rate and Percent Debt, 10 Year Repayment, With 10% Patient Capital Paid Back In Years 5 to 10, (Bold Indicates Negative Cash Flow)

Interest Rate / % Debt	0%	10%	20%	30%	40%	50%	60%	70%	80%
0%	8.0	8.5	9.1	9.9	10.9	12.2	13.9	16.8	22.6
1%	8.0	8.4	9.0	9.7	10.6	11.7	13.3	15.6	20.3
2%	8.0	8.4	8.9	9.5	10.3	11.2	12.6	14.6	18.3
3%	8.0	8.3	8.8	9.3	9.9	10.8	11.9	13.5	16.3
4%	8.0	8.3	8.6	9.1	9.6	10.3	11.2	12.4	14.5
5%	8.0	8.2	8.5	8.8	9.3	9.8	10.5	11.4	12.8
6%	8.0	8.1	8.4	8.6	8.9	9.3	9.8	10.4	11.3
7%	8.0	8.1	8.2	8.4	8.6	8.8	9.1	9.6	10.0
8%	8.0	8.0	8.1	8.1	8.2	8.3	8.4	8.5	8.7
9%	8.0	7.9	7.9	7.9	7.9	7.8	7.8	7.7	7.5
10%	8.0	7.9	7.8	7.7	7.5	7.3	7.1	6.8	6.5
11%	8.0	7.8	7.6	7.4	7.2	6.9	6.5	6.0	5.5
12%	8.0	7.7	7.5	7.2	6.8	6.4	5.9	5.3	4.6

Combinations of interest rates and percentage of debt resulting in at least 1 year of negative cash flows are highlighted in bold. The first thing to note is the patient capital contribution adds 0.7% (8.0% - 7.3% (Table 4)) to the IRR before any other money is borrowed. Given current interest rates in the 6% to 8% range, the

barn still cannot be more than 50% debt financed. Higher percentage debt financing will result in negative cash flows in at least 1 year. However, the patient capital does result in a higher IRR to the barn owner. In the case of the 6% interest rate the advantage is +1.1% (9.3% - 8.2% (Table 4)). This difference is showing the effects of financial leverage.

Conclusions

There are at least three conditions within the barn enterprise that have to be met in order for it to become economically viable. The first condition is the life of the contract. If the barn has a serviceable life of 20 years, it must be full of pigs for all or most of that time to generate competitive rates of return (15%). Most industries are so risky that no company is going to sign a 20 year contract, but hog owners have indicated that they would rather rely on contract feeders than build the barns themselves. The reasons hog owners give for not wanting to own the barns themselves is because of the huge investment required. Other reasons not expressed as often are negative reaction from communities when many barns are being built and that the rates of return are not competitive.

The second condition required to make contract finishing of hogs in Western Canada a viable enterprise is the capture of the nutrient value of the manure. The hog owners have not been able to capture the nutrient value of the manure because the surrounding landowners have not been willing to pay the nutrient value of the manure. However, a contract finisher of hogs can locate the barn in the middle of their own land and take full advantage of the nutrient value of the manure. Though they may not physically transfer funds from their cropping enterprise to their contract finishing enterprise, there is a net value that one of the enterprises does capture.

The third condition is financial leverage. If the first two conditions are met and interest rates stay below 8%, contract finishers of hogs can use financial leverage to their advantage. The addition of a 10% patient capital also helps the economic viability of the enterprise.

References

Nagy, C.N., J.J. Schoenau, and R.A. Schoney. *Economic Returns and Hauling Distance of Hog and Cattle Manure*. 2000.

Saskatchewan Agriculture and Food. *Statistics Handbook*, 2005.

Saskatchewan Agriculture & Food. *Tri-Provincial Manure Application and Use Guidelines, Fact Sheets*, 2006

Sask Pork. *Sask Pork Annual Report 2003-2004*. Saskatoon. 2005