A feasibility study of the expansion of swine and management for Iowa State University's AG 450 farm

by

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ABSTRACT

For more than 70 years, the Iowa State University Ag 450 Farm has been in operation south of the Iowa State University (ISU) campus located in Ames, Iowa. The Ag 450 farm is currently the only student managed farm at a land grant university in the United States. The idea for the Ag 450 Farm was developed by Dr. William Murray in 1938 and in 1943, the Ag 450 class was first offered by Dr. Murray.

At the farm, the core principals of agribusiness and farm management have been taught while adapting to an ever-changing agriculture. The Ag 450 Farm is considered the capstone course for the Iowa State University Agricultural Studies major. ISU Ag 450 is currently under the supervision of farm manager Greg Vogel and the Iowa State University Agriculture and Studies Department.

Today, the Iowa State University Ag 450 students manage approximately 275 acres of owned ground, 700 acres of cash rented ground, 80 acres of crop share ground, and 800 acres of custom farmed ground depending on the year. Ag 450 represents a commercial farming enterprise of corn and soybean production as well as housing nursery piglets and custom finishing over 1000 head of feeder pigs.

In its current condition, the ISU Ag 450 is looking to expand its operations to meet the demands Agricultural Studies majors at Iowa State University. A focus of the expansion is to increase the amount of custom finished feeder pigs by building another finishing facility. That type of expansion requires the need for another full-time farm manager. This research examines the feasibility of expansion of the swine and management to determine the impact this may have on the future viability of the farm.

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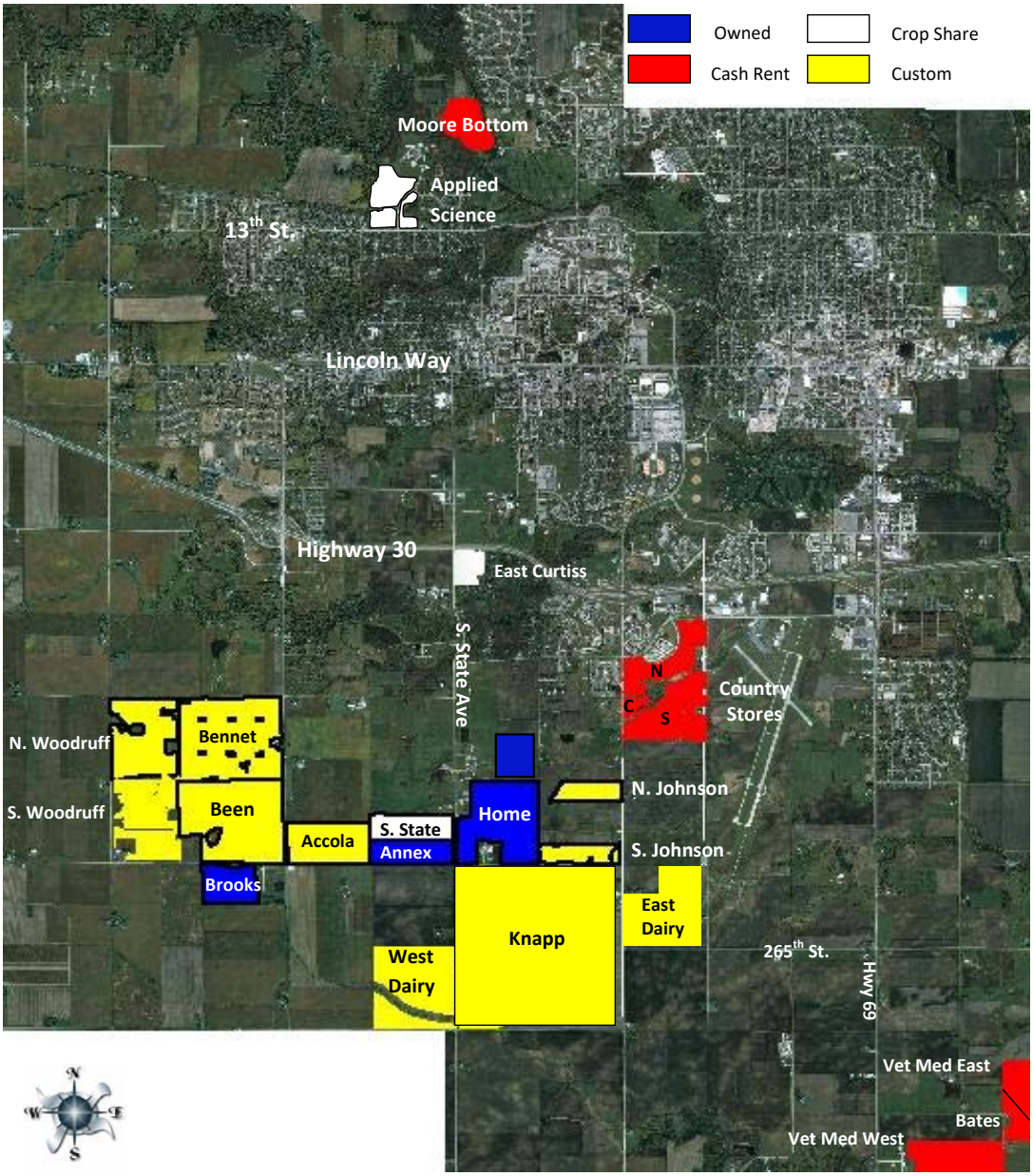
CHAPTER I: INTRODUCTION

1.1 Introduction

This research was carried out for the Iowa State University Agriculture 450 farm located in Ames, Iowa. The Iowa State Agriculture 450 Farm is the only student managed farm in the United States and has been in operation for more than 70 years. Ag 450 students are responsible for making all decisions regarding the farm under the supervision of farm manager Greg Vogel and the Iowa State University Agricultural Studies Department faculty.

Figure 1.1 is an aeriel overview of the Iowa State University Ag 450 Farm. The figure shows the owned ground that is highlighted in blue, cash rented ground in red, custom farmed ground in yellow, and crop shared ground in white. The physical structure for the Ag 450 Farm is located at the home field shown in blue. Physical structure includes livestock buildings, grain storage, machine sheds, farm house, and a classroom. Ag 450 students travel to the home place classroom for weekly class and committee meetings. Students also travel to the farm during the week to assist with farming operations. As shown in the figure, the home farm is located just south of the Iowa State University campus with much of the farmed ground close to the campus.

Figure 1.1: Iowa State University Ag 450 Farm Aeriel Map



(Iowa State University Ag 450 Farm n.d.)

1.2 Objective and Challenges

Presently, the Ag 450 Farm is looking to expand over the next 2 to 3 years in someareas of operation. The farm is looking to expand and upgrade the on-farm classroom facilities, grain facility, owned and custom farmed ground, feeder pig operation, and potentially invest in a solar energy power grid to become self-sustainable. The Ag 450 Farm will have staff changes in the next three years and needs to put together a transition plan for a new farm manager and needs to examine management depending on the expansions that take place. Overall, the Ag 450 Farm is creating a long-term outlook that brings a focus and vision to the strategic direction the farm.

The research begins with a current financial analysis of the Ag 450 Farm to determine where they are financially. Past financial reports and net worth statements were compiled into one concise overview that was used to benchmark to averages of similar farms in the area. This data were obtained from the Iowa Farm Business Association and the Agricultural Resource Management Survey (ARMS) data from the USDA. Benchmarking information for the Ag 450 Farm will assist in deciding among the expansion projects chosen for recommendation.

The 30-year strategic plan created by the Ag 450 class was used in combination with input from the farm manager to identify issues that have the largest impact on the transitions that the 450 farm is facing. Selection of a single issue was critical to the creation of a useful but concise research project with focus on obtaining results that would be valuable to the Ag 450 Farm.

The expansion of the swine enterprise was identified as the primary issue. Specifically, data were gathered and research conducted based on past improvements or

transitions of the farm. Data were used to analyze a future expansion of the swine finishing enterprise and determine the viability of the proposal.

The feasibility of building an analytical model for swine enterprise expansion was also examined. This model would be used by Ag 450 students to help them make a knowledgeable decision on the expansion projects.

1.3 Issue Identification

As stated in the objectives, before any research or study could be conducted, a specific issue for evaluation was identified. The farm manager, Greg Vogel, provided insight into the issues to evaluate. The common theme regarding upcoming transition challenges facing the farm quickly emerged. These challenges were not focused as much on raw numbers of each individual expansion project but the idea of staffing needs with respect to farm management employees, student enrollment increases, and how the farm needs to expand to be able to financially meet the needs of increasing staff and students.

The main expansion project is to build another swine finishing barn. The projected income received from the construction of the new barn needs to be enough to offset the financial requirements to bring another full-time farm manager on board. The desire to hire another full-time farm manager is driven by the increasing number of students each semester and the increasing daily duties of the Ag 450 Farm. Mr. Vogel will be retiring in 2019 and will be replaced with at least one farm manager. The central question of this research is to determine if a management increase of the Iowa State University Ag 450 Farm, along with the expansion of the swine finishing operation, are a viable option for the farm in the future. To be viable, the projected return on investment for building a new swine finishing barn should offset the required funds needed to pay the salary of a second farm manager.

CHAPTER II: LITERATURE REVIEW

2.1 History

In 1943, the Agriculture 450 Farm began as a concept created by Dr. William Murray, Professor of Economics at Iowa State University. Dr. Murray thought that students needed the experience managing an actual farm to better prepare them for farming and other related occupations (Iowa State University Special Collections Department 1943-2012).

On July 1st, 1943, the Agriculture 450 farm was established as an independent educational enterprise under Dean Kildee at Iowa State University. There was a startup budget of $10,500 granted by the university with Dr. William Murray as the instructor. In its first year, the Ag 450 Farm was 187 acres of land that consisted of a diverse row crop, dairy cattle, beef cattle, swine, and poultry operations. In the 1943 cropping season, there was a profit of $1,969 (Murray 1943).

As the farm started to grow, there was a need for a long-term improvement plan. In 1946, a 10-year improvement plan was put into place by the Ag 450 Farm class. Improvement areas included the dwelling house, buildings for the swine, dairy cattle, beef cattle, poultry, horses and miscellaneous projects. Projects in the miscellaneous category included machinery, buildings, and grounds improvement projects that were not directly connected to livestock (Elderkin 1946).

At this time, the layout of the written report was well planned, and the improvement plan consisted of an introduction followed by the projects. Once the projects were described in depth, there was a proposed schedule of improvement to conclude the report. The 1946 plan focused on livestock, with farm projects and decisions that revolved around the livestock operations over a ten-year period. Many analyses were conducted, with the

help of Iowa State University to determine the parameters of the expansions of the different livestock entities. These analyses were done based on 173 the crop acres the farm maintained in 1946.

In the 1960s, the swine enterprise was expanded and beef cattle were added to the farm. The mid 1970s saw the addition of a full line of equipment owned by the farm and used in daily operations. By 1980, specialization of the farm became the focus as the swine operation was again expanded and additional row-crop acres were purchased (Iowa State University Ag 450 Farm n.d.).

Today the class is made up of undergraduates in their junior and senior year at Iowa State University. The experience is considered the capstone course for the Agricultural Studies curriculum. Each class lasts for a semester and is broken down into subcommittees. These committees include crops, machinery, finance and marketing, public relations, custom operations, swine, and buildings and grounds. The class meets twice a week, one day in the classroom in a business meeting format, and the other is spent at the teaching farm working in committees and helping with general labor. In the business meeting, decisions are discussed and voted on by the entire class. At the farm, these decisions are implemented by the committees and as an entire group.

The Ag 450 Farm has been operated in this manner since its inception in 1943. At Iowa State University, Ag 450 is a unique course in applied farm management, spanning several disciplines. For over 70 years, students have wrestled with the problem of managing the farm (Honeyman 1983). Table 2.1 is a list of major improvements made by the Ag 450 Farm from 1959 through 2015. This chart illustrates how specialization in the swine operation became more prominent after the 1980s.

Table 2.1: Ag 450 Farm History of Facility Improvements

Year	Improvement	Cost (if known)
1959	Farm House	Moved from campus
1964	Cattle Shed	Free-Moved from National Animal Disease Center Farm
1965	Swine Shed	$1,280
1966-67	Four bin grain system added	$14,000
1970	Ten-ton scale and livestock handling facility	$1,327
1970	Pole Machine Shed 44' by 60'	$4,337
1973	Concrete stave silo, 18' by 60'	$7,000
1974	Cargill swine growing and finishing unit	$23,500
1977	Farrowing house, 22 stall	$40,000
1978	Nursery addition to farrowing house, 200 head	$30,500
1984	48 acres purchased	
1992	32 acres acquired	
1992	New cattle/multipurpose shed, 96' by 32'	
1995	Barn fire. Insurance money used to remodel farrowing house to 32 stall	25,000
1995	Constructed new 400 head nursery 64' by 20'	$55,000
1997	Constructed 1200 head confinement finisher	$258,000
1999	Expanded to custom farming for ISU	
2003	Renovated 96' by 32' building to confinement breeding barn for swine	
2007	Swine operation changed from farrow-finish to custom feeding	
2007	Renovated gestation barn to finishing barn	$25,000
2009	Constructed 48', 50,000 bushel grain bin	$83,792
2015	New grain dryer project	$119,750

(Honeyman 1983, Iowa State University Ag 450 Farm n.d.)

2.2 Methods Oriented

A feasibility study was the main method utilized to research this project. Using Iowa State University's Ag Decision Maker, a feasibility study is an analysis of the viability of an idea (Hofstrand and Holz-Clause, Ag Decision Maker 2009). This type of study is used in business ventures looking to create a new idea or expand on an existing part of the operation. A feasible business venture is one where the business generates adequate cash-flow, withstand the risks that it will encounter, remains viable in the long term, and meets the goals of the founders (Hofstrand and Holz-Clause, Ag Decision Maker 2009).

The Iowa State Ag 450 Farm swine barn expansion project was identified as the key focus for this study. While performing this study, several aspects of interest were considered including project description, market feasibility, technical feasibility, financial/economic feasibility, and organizational/managerial feasibility.

2.3 Theory Oriented

The objective of the research is to analyze the feasibility of the Ag 450 Farm swine barn expansion and staff increase. Theory will allow for the necessary assumptions underlying the analysis. There are two main needs that this expansion project should consider: managerial needs and economic needs. A hypothesis that coincides with these needs is that if the new swine facility is built, an additional full time farm manager will be added to the payroll using the revenue from the new swine barn.

Usingthe net present value rule and sensitivity analysis, the project will determine whether it will be viable in the future. By calculating the net present value of the swine barn, the expected value is established. Some of this groundwork has already been completed by the Ag 450 Farm such as the additional pigs will be fed on contract. Thus, several of the assumptions have been studied. Estimating the net present value of the project will examine profitability over time.

Completing a sensitivity analysis will help to discover the most important variables affecting the expansion. One of the main issues identified by the farm director was the repayment period on the loan for the finishing barn. Ag 450 will obtain a loan to build the barn through Iowa State University. The current repayment period will be five years but if that period can be negotiated to a longer ten-year period, the farm may be able to have less capital tied up on an annual basis, have a better chance in being able to afford an additional farm manager, and better use its resources. If a ten-year repayment plan would financially benefit the operations of the Ag 450 Farm, Ag 450 would be able to use this information when negotiating loan terms for the new swine finishing barn.

CHAPTER III: DATA

Before determining if a staff increase and the building of another swine finishing barn is feasible, there is a need to evaluate the current financial standing of the Ag 450 Farm. Current and past financial statements from Iowa State University and the Ag 450 Farm were obtained. The past four years of financial history of the Ag 450 Farm were examined and an analysis of the financial ratios was completed. These numbers were compared to the averages for farm businesses within the state of Iowa. The comparative data for Iowa farms was derived from the United States Department of Agriculture (USDA) Agricultural Resource Management Survey (ARMS).

3.1 USDA ARMS Data

A tailored report was created using the farm structure and finance section of the ARMS data (United States Department of Agriculture 2016). This section provides information on farm structure, financial status, and performance of United States farm operators, their households, and farm businesses. Filters are available for the state of Iowa and only farm businesses were selected to narrow the search to be as comparable as possible to the Ag 450 Farm. The most current data available through the USDA reflects the 2015 information that was updated in December of 2016.

Table 3.1 shows the average net cash farm income statements for Iowa farm businesses from 2013 to 2015. This comparative data reflects the large swings in commodity prices that have occurred. Taking this variability into account enables the researcher to examine profitability with the commodity price shifts.

Table 3.1: Farm Finances for Farm Businesses: Iowa

	2013	2014	2015
	$49,825.00	$45,480.00	$47,127.00
Gross cash income	$605,446.00	$609,581.00	$524,937.00
Livestock income	$222,131.00	$235,381.00	$199,991.00
Crop sales	$295,554.00	$282,350.00	$247,328.00
Government payments	$12,104.00	$7,475.00	$19,124.00
Other farm-related income	$75,657.00	$84,375.00	$58,495.00
Total cash expenses	$395,629.00	$434,247.00	$372,593.00
Variable expenses	$297,413.00	$323,794.00	$271,482.00
Livestock purchases	$49,837.00	$62,257.00	$56,339.00
Feed	$61,992.00	$62,553.00	$48,617.00
Other livestock-related	NA	$8,835.00	$9,081.00
Seed and plants	$39,426.00	$42,433.00	$37,543.00
Fertilizer and chemicals	$65,747.00	$65,618.00	$56,299.00
Utilities	$5,524.00	$6,479.00	$4,779.00
Labor	$13,705.00	$19,114.00	$13,152.00
Fuels and oils	$17,433.00	$20,068.00	$12,941.00
Repairs and maintenance	$22,292.00	$21,840.00	$19,655.00
Machine-hire and custom work	$5,676.00	$6,894.00	$6,095.00
Other variable expenses	$7,545.00	$7,703.00	$6,981.00
Fixed expenses	$98,217.00	$110,453.00	$101,111.00
Real estate and property taxes	$7,133.00	$8,252.00	$7,871.00
Interest	$11,378.00	$14,555.00	$13,852.00
Insurance premiums	$15,555.00	$16,507.00	$13,420.00
Rent and lease payments	$64,151.00	$71,139.00	$65,967.00
Net cash farm income	$209,817.00	$175,334.00	$152,345.00

(Hopkins, United States Department of Agriculture Economic Research Services 2016)

Table 3.2 notes the percent change in gross cash income and total cash expenses for Iowa farm businesses from years 2013 to 2015. This provides a clearer understanding on how the market has shifted over the last few years.

Table 3.2: Percent Change in Gross Cash Income and Total Cash Expenses for Iowa Farms

	Gross Cash Income	Total Cash Expenses
% Change '14-'15	-13.89%	-14.20%
% Change '13-'14	0.68%	9.76%

From 2013-2014, there was a less than 1 percent increase in gross cash income for Iowa farm businesses. Total cash expenses rose just short of 10 percent. In 2014-2015 gross cash income decreased by about 14 percent and cash expenses decreased about 14 percent. This table suggests that from 2013-14 as commodity prices were on the decline, farming inputs had not adjusted and were still rising at a much higher rate than the cash inflows. The decline of commodity prices is shown in the net farm income. Net farm income is the gross cash income minus the total cash expenses. In 2013, the average Iowa farm business had gross cash income of $605,446 and total cash expenses of $395,629. Two years later in 2015, the gross cash income was $524,937 while total cash expenses were $372,593. In the time between 2013 and 2015 the average gross cash income for Iowa farm businesses decreased about $80,000 while expenses decreased about $23,000. The 2014-15 cropping season data reflect the adjustment of cash expenses with the markets allowing for a much more comparable percentage change to the average cash incomes for Iowa farm businesses.

3.2 Iowa State University Ag 450 Farm Data

Comparing the net cash incomes for the Iowa State Ag 450 Farm required additional analysis. Many similarities and differences between the Ag 450 Farm and the average Iowa farm business were identified. One difference was that as a university entity, the Ag 450 Farm operates with two separate accounts as opposed to a singular farm account. The two Ag 450 Farm accounts are made up of a cash account and an Iowa State University revolving account. The cash account handles most day to day transactions as

well as most operating expenses. The university account deals with loans, long term expenses, and some operating expenses as well. Ag 450 Farm has the advantage of borrowing through the University, which is why loans are handled through the revolving account. In table 3.3, an overview of the Ag 450 Farm's net income statements from 2013 through 2016 is presented. The criteria for the USDA ARMS data was used to define cash inflows and outflows for consistency when comparing the two operations (United States Department of Agriculture 2016).

Table 3.3: Net Income Statement for Iowa State University Ag 450 Farm

	2013	2014	2015	2016
Gross Cash Income	$636,717.31	$395,736.68	$423,876.68	$716,242.45
Livestock Income	$60,850.08	$60,850.08	$65,992.58	$60,850.08
Crop Sales	$444,031.50	$205,945.87	$259,897.77	$461,866.17
Government Payments	$7,895.00		$0.00	$91,590.00
Other Farm Income	$123,940.73	$128,940.73	$97,986.33	$101,936.20
Total Cash Expenses	$523,379.86	$562,329.48	$502,768.78	$596,888.10
Variable expenses	$429,808.15	$442,229.92	$353,881.86	$430,092.19
Livestock purchases				
Feed				
Other livestock-related/2	$30,753.61	$26,905.42	$26,726.09	$22,702.94
Seed and plants	$41,803.66	$70,772.41	$69,404.43	$47,351.88
Fertilizer and chemicals	$145,171.82	$144,553.55	$103,001.85	$102,336.96
Utilities	$8,703.58	$7,802.78	$8,026.99	$11,282.65
Labor	$71,420.52	$61,450.19	$73,761.83	$98,990.40
Fuels and oils	$28,214.37	$28,849.10	$23,722.10	$13,799.15
Repairs and maintenance	$75,905.60	$72,796.16	$26,340.18	$77,850.05
Machine-hire and custom work	$26,778.95	$23,832.85	$19,307.06	$19,095.88
Other variable expenses/3	$1,056.04	$5,267.46	$3,591.33	$36,682.28
Fixed Expenses	$93,571.71	$120,099.56	$148,886.92	$166,795.91
Real estate and property taxes				
Interest	$0.00	$3,105.00	$4,597.50	$5,736.30
Insurance premiums	$46,165.51	$38,689.56	$48,440.42	$53,269.60
Rent and lease payments	$47,406.20	$78,305.00	$95,849.00	$107,790.01
Net cash farm income	$113,337.45	-$166,592.80	-$78,892.10	$119,354.35

The net farm incomes from the Ag 450 Farm showed more variability than the average Iowa farm business. The net farm income for 2013 is close to the USDA numbers but from 2013 to 2014 a drastic decrease in net cash income was recorded. A slight increase was observed from 2014 to 2015 and then from 2015 to 2016 there was a larger increase. Table 3.4 shows the change in percent of the gross cash incomes and total cash expenses for the ISU Ag 450 Farm from 2013 to 2016.

Table 3.4: Percent Change in Gross Cash Income and Total Cash Expenses for ISU Ag 450

	Gross Cash Income	Total Cash Expenses
% Change '15-'16	68.97%	18.72%
% Change '14-'15	7.11%	-10.59%
% Change '13-'14	-37.85%	7.44%

As Table 3.4 indicates, the change in gross cash income and total cash expenses was more variable than the state of Iowa averages. Although there are large changes, the farm manager provided an explanation. The Ag 450 Farm is run by a classroom of students; thus, there are a few additional variables that must be considered when comparing the numbers. First off, the class changes hands every semester and when it changes hands, so do the business strategies of the farm. Each class is able to decide on their operating strategy at the beginning of the semester. For example, the change in gross cash income from 2013 to 2014 was nearly 38 percent. An assumption that could be made for that drop is that the 2014 classes took a more conservative approach to marketing and did not sell as many bushels. Also, it should be recognized that the increasing rent and lease payments may have had an affect on the negative cash incomes as well.

It should also be noted that the 2016 net income would be much more comparable to the 2015 net income except that there was a large government payment received. Looking at the previous years, a payment like the 2016 is not normal and without it the 2016 net income would change dramatically. Another factor to consider for the 2016 cropping year is the other variable expense line item. This variable expense is much higher in 2016 due to the increased grain drying costs that did not occur in the previous years. On a final note, no depreciation was included, nor was non-cash benefit labor, inventory change in value, or non-money income. Ag 450 does not factor in depreciation of assets

within the annual financial statements due to the tax-exempt university operation status. Using an average number or percent for depreciation was considered, but rejected because it would not reflect on the actual operation of Ag 450.

3.3 Financial Ratio Analysis

Along with the income statements from previous years, the financial ratios of the Ag 450 Farm were compared to the USDA ARMS data for an average Iowa farm business. Relevant ratios for the business were selected. These ratio categories included liquidity, solvency, profitability, and financial efficiency to gain a deeper understanding of the performance of Ag 450 Farm is as an operation. This analysis helped to illustrate the financial soundness of the Ag 450 Farm. Table 3.5 shows the financial ratios for average Iowa farm businesses for years 2013 to 2015 and table 3.6 shows the financial ratios for Ag 450 for years 2013 to 2015.

Table 3.5: Financial Ratios for Average Iowa Farm Businesses 2013 through 2015

	2013	2014	2015
Current Ratio	2.8	2.3	1.9
Debt/Asset Ratio	10.00%	14.80%	16.60%
ROA	4.00%	3.50%	2.70%
ROE	4.10%	3.50%	2.50%
Asset Turnover Ratio	20.00%	20.00%	20.00%

(Hopkins, Economic Resesarch Services (US) 2016)

Table 3.6: Financial Ratios for ISU Ag 450 Farm 2013 through 2015

	2013	2014	2015
Current Ratio	3.5	1	1.4
Debt/Asset Ratio	4.62%	5.33%	4.99%
ROA	4.16%	-3.97%	-1.88%
ROE	4.36%	-4.27%	-2.09%
Asset Turnover Ratio	23.37%	9.43%	10.09%

The current ratio measures liquidity and is calculated by dividing the total current farm assets by the total current farm liabilities (Total Current Farm Assets / Total Current Farm Liabilities). A desirable range for this ratio is 1.5 to 2.0 (Berry 2017). For the average Iowa farm businesses, each year is above the 1.5 range (Table 3.6). Having a ratio above 1.0 indicates that current assets exceed current liabilities and the operation should have the liquid funds available to make the payments on the liabilities owed. Ag 450's current ratio for 2013 was 0.7 of a point higher than the average Iowa farm business but then dropped below the Iowa average in 2014 by 1.3 points and just slightly below the 2015 Iowa average by 0.5 points. Although the current ratio for the Ag 450 Farm was slightly less than the Iowa average in 2014 and 2015, it is still above 1.0 meaning that Ag 450 is financially liquid and should be able to pay off current liabilities from year to year.

The debt to asset ratio measures solvency and was calculated by dividing the total farm liabilities by the total farm assets (Total Farm Liabilities / Total Farm Assets). The desirable range is less than 0.4 or 40% (Berry 2017). Both the Iowa farm business average and Ag 450 have debt to asset ratios that are significantly lower than 40% from years 2013 to 2015. In all cases, Ag 450 has a debt to asset ratio that is at least less than 5% or greater from the years shown in Table 3.5. This signifies that the Ag 450 Farm is solvent and carrying a lower amount of debt than the average Iowa farm business.

The rate of return on farm assets looks at profitability and was calculated by adding the net farm income from operations to farm interest expense, subtracting the operator management fee and then dividing that number by the average total farm assets ((NFIFO + Farm Interest Expense – Operator Management Fee) / Average total Farm Assets). A desirable range is greater than 4% (Berry 2017). In 2013 the Iowa farm business

average was at 4% while Ag 450 was slightly above at 4.16%. In 2014-2015, Iowa farm businesses decreased steadily while the Ag 450 decreased drastically to -3.97% in 2013 and then rose to -1.88% in 2015. The negative ROA ratios in 2014 and 2015 for Ag 450 are reflected by the negative cash farm incomes listed in Table 3.3. These negative ratios could suggest that for years 2014 and 2015, the total farm assets owned had a negative impact on the earnings generated by the Ag 450 Farm. This could be the result of lower commodity prices and commodity marketing strategy as discussed previously.

The rate of return on farm equity also looks at profitability and is calculated by subtracting the operator management fee from net farm income from operations and dividing it by the total farm equity (NFIFO – Operator Management Fee) / Total Farm Equity. An ideal range is greater than the rate of return on farm assets (Berry 2017). ROE looks at how efficiently the business can generate a dollar of income per dollar of total equity or assets minus liabilities. For both the average Iowa farm business and Ag 450 Farm, the ROE is very similar in percent with the ROA. The ROE for the average Iowa farm businesses does drop lower than the ROA in 2015. Ag 450 Farm's ROE was slightly higher than the ROA in 2013 but does drop lower than the ROA in 2014 and 2015. Overall, the movement is consistent throughout the time period of 2013 to 2015. Again, this can be explained by Ag 450 Farm's negative net farm income for 2014 and 2015.

Asset turnover ratio is a measurement of financial efficiency and is calculated by dividing gross revenue by average total farm assets (Gross Revenue / Average Total Farm Assets). An ideal range for this ratio is greater than 25% to 30% (Berry 2017). Both average Iowa farm businesses and Ag 450 Farm fall short of the ideal asset turnover range in the years from 2013 through 2015. The average Iowa farm business asset turnover ratio

does stay consistent at 20% (Table 3.6) while the Ag 450 Farm ratio drops significantly from 23.37% in the years 2013 to 9.43% in 2014 (Table 3.5). Their ratio does increase slightly to 10.09% in 2015. This can be explained by lower commodity prices and therefore assets owned are not able to be used as efficiently when the return on those assets is lower. The asset turnover ratios shown by the Ag 450 Farm does not signify financial instability rather than just a lower amount of operation efficiency for years 2014 and 2015.

3.4 Common Balance Sheet Comparisons

Common balance sheets for the Ag 450 Farm and the average Iowa farm business were created for comparison. For these balance sheets, the USDA's balance sheet structure was used to compile the Ag 450 Farm's information to achieve uniformity. The numbers used to build the balance sheet for Ag 450 came directly from the corresponding net worth statements. The years 2013 through 2015 were used to get a uniform comparison. All line items in the balance sheet are expressed as a percentage of total assets. By doing this type of comparison, the financial model of Ag 450 compared to the average Iowa farm business is observed.

A value for the operators dwelling was not included in comparison because Ag 450 does not put a value to the dwelling in their net worth statements. Also, the USDA does place a value to the operator dwelling in their numbers, but that number is not included in total assets. USDA only includes the value of this asset if it is owned by the business. When the percentages were initially summed, the total asset percentage values were found to be greater than 1 which would skew the comparison to the Ag 450. By removing the operators dwelling category, the total asset percentages for the USDA ARMS

equaled exactly 1. If dwelling is owned by the business, the USDA adds that value into the land and buildings line.

A definition for the line labeled other within the current assets category should be identified. According to USDA, the other category includes accounts receivable, certificates of deposit, checking balances, savings balances, and any other financial assets of the farm business.

Table 3.7 shows comparison of the percent of total assets and liabilities between the USDA ARMS average numbers for Iowa farm businesses, and the ISU Ag 450 Farm for 2015. In the assets category there are a number of similarities and most of the lines are within a percent or two of each other. The land and buildings line constitutes an important difference. The Ag 450 Farm has 10% more assets tied up in land and buildings than an average Iowa farm business. A large percentage such as this could lead to financial stability for the Ag 450 Farm. Land as an asset, brings financial reliability. Currently, the return to land ownership in the state of Iowa from 1970-2009 is 7.0 percent (Hofstrand and Edwards, Ag Decision Maker 2010).

There are three lines of difference in the farm liabilities category. In the notes payable within one year category, Ag 450 has a little over 45 percent more of their liabilities tied up in those notes than the average Iowa farm business. This could be partially caused by timing and each year the year the net worth statement was put together by the Ag 450 Farm. Per the Ag 450 Farm net worth statement for 2015, the 71.6 percent of liabilities are for their operating note.

The other line that shows some difference is that of the non-real estate liabilities. Ag 450 is slightly above the Iowa average and that is recognized as current borrowing on

machinery. The last line is the livestock inventory assets. Ag 450 shows a 0% of livestock inventory because all the livestock that is on the farm is custom fed and not owned by the farm. All in all, regarding liabilities, the Ag 450 Farm appears to be very stable as over two thirds of liabilities are in short term debt such as annual operating notes and less than one third are in intermediate debt while carrying less interest than an average Iowa farm business.

Table 3.7: 2015 Balance Sheet Comparisons for USDA Iowa Farm Businesses and ISU Ag 450 Farm

2015	USDA Iowa Farm Business	ISU Ag 450 Farm
	% Total Assets	% Total Assets
Farm Assets	100.0%	100.0%
Assets: Current	12.8%	5.1%
Assets: Livestock inventory	3.0%	0.0%
Assets: Crop inventory	4.7%	3.3%
Assets: Purchased inputs	1.0%	0.7%
Assets: Cash invested in growing crops	0.1%	0.0%
Assets: Prepaid insurance	0.1%	0.0%
Assets: Other /1	3.9%	1.1%
Assets: Non-current	87.2%	94.9%
Assets: Investment in cooperatives	0.4%	0.0%
Assets: Land and buildings /2	74.8%	86.8%
Assets: Operators dwelling	0.0%	0.0%
Assets: Farm equipment	10.5%	8.1%
Assets: Breeding animals	1.6%	0.0%
	% Total Liabilities	% Total Liabilities
Farm Liabilities	100.0%	100.0%
Liabilities: Current	41.3%	73.0%
Liabilities: Notes payable within one year	26.3%	71.6%
Liabilities: Current portion of term debt	7.8%	0.0%
Liabilities: Accrued interest	2.8%	1.4%
Liabilities: Accounts payable	4.4%	0.0%
Liabilities: Accounts payable	58.7%	27.0%
Liabilities: Accounts payable	12.4%	27.0%
Liabilities: Accounts payable	46.3%	0.0%
Liabilities: Accounts payable	$2,143,662	$3,992,084

3.5 Swine Finishing Barn Data

Data for building the Net Present Value (NPV) model for the projected swine finisher barn was obtained from the ISU Ag 450 Farm manager Greg Vogel. Past cash flows were obtained from the Ag 450 Farm class and Iowa State University Ag Decision Maker. The numbers provided may change should the Ag 450 Farm decide to move forward with the project in the future.

3.5.1 Projected Variable Costs

The main variable costs for the swine finishing buildings are labor, electricity, water, and repairs. A value of $5.00 per head per year for the labor cost was provided by Mr. Greg Vogel. The electricity cost was $4.63 per head annually and was determined by the most recent cash flow provided by the Ag 450 Farm. The total current electric costs for the 1,200-head finisher barn was divided by the total head.

Water costs were $2.78 per head annually and were calculated using past cash flows and taking the total water costs for their current finishing barn and dividing that by the total current head. To estimate a value of repairs, annual repair costs were figured at 1.5% of the buildings original value annually (Lawrence and Ellis 2008). Taking the 1.5% of the 900-head, and 1,200-head original cost, annual repairs were estimated. For the 900-head barn, repairs are valued at $3.84 per head per year and for the 1,200-head barn, repairs would be $3.78 per head per year.

3.5.2 Projected Fixed Costs

Fixed costs for the new swine finishing facilities include the initial investment and a ten-year equipment replacement. The initial building costs are valued at $30.00 per square foot (Vogel 2016). The 900-head barn would be 80 by 96 square feet, this would be

multiplied by $30.00 to get the total building cost of $230,400. The 1,200-head barn would be a 42 by 240 square foot building. When multiplied the total square feet by $30.00, the total building cost is $302,400.

Major repair costs throughout the lifetime of the building were included. According to Ag Decision Maker, the lifetime of a finishing barn should be 25 years with equipment replacement every 10 years (Lawrence and Ellis 2008). A finishing facility should be valued at 70% as building structure and 30% as building equipment (Lawrence and Ellis 2008). To put a value to the 10-year equipment replacement, 30 percent of the total projected cost for the 900 and 1,200-head barns was assumed, there was $69,120 for the 900-head barn and $90,720 for the 1,200-head barn.

3.5.3 Projected Income

Numbers for annual income were estimated by Mr. Vogel for the Ag 450 Farm. The current income projections are $41 per pig space annually. Multiplying the $41 per pig space by the total number of head provides the annual income. The income is calculated per pig space in the barn by a contract through Cactus Family Farms. Ag 450 will be paid per pig space and not pigs produced or sold. There are also no penalties included in the contract for death loss. The contract would be renewed annually and the price per pig space is guaranteed at a minimum for 12 months. This makes it an easy contract for Ag 450 and allows them to plan for a guaranteed income with less risk associated with production.

CHAPTER IV: CONCEPTUAL MODELS AND METHODS

4.1 Conceptual Model Explanation

Financial models for this project were built to examine the feasibility of building a new swine finishing facility. Ag 450 is looking to possibly hire a second full time farm manager. To provide revenue for a new position like this, Ag 450 is considering expanding their current swine finishing operation and build a new 900-head or 1,200-head barn. A cost projection was put together for both barn scenarios.

In this model, Net Present Value (NPV) is used to determine the value of each project at the end of the lifetime. The projected costs and incomes identified earlier are used to calculate NPV. NPV is defined as the difference between a project's value and its cost (Brealey, Myers and Allen 2014). The NPV rule recognizes that a dollar today is worth more than a dollar tomorrow (Brealey, Myers and Allen 2014). This is true because a dollar can be invested today to start earning interest and will be worth more than a dollar tomorrow that has not earned that interest.

Another important aspect of NPV is that it is solely based on forecasted cash flows. This rule is true for the conceptual models built for Ag 450 and as the actual costs are accumulated during the life of the project, the NPV will change as well. Also, the NPV of the models will depend on the opportunity cost of capital. The opportunity cost of capital is an estimated rate of return on investment if the money used for that project was invested elsewhere. By using a common rate such as the federal bond interest rate, CD, or historical return on an agricultural asset such as farm ground, the project's opportunity cost can be realistic and provide the most accurate NPV possible.

The internal rate of return is also calculated. The IRR of the project indicates if it will be successful or not. The IRR rule is that a project should be accepted if the IRR is higher than the cost of capital. The cost of capital in this situation is the interest rate on the money borrowed to start the project. Sensitivity analysis will be used to look at different aspects of the projects to help confirm project success. Relationships between variables will be addressed as well with sensitivity analysis.

CHAPTER V: PROCEDURES AND METHODS

5.1 Procedure Overview

Procedures for the model were based on the idea of a feasibility study allowing for a focus on different aspects of the proposed ideas so that the results would produce accurate information to draw solid conclusions. The areas of focus for the feasibility study were market feasibility, financial/economic feasibility, and managerial feasibility. A section that focuses on the question of loan repayment for Ag 450 is also included as a repayment analysis.

5.2 Project Description

The focus of this project was to determine the feasibility of building a new swine finishing facility on the Ag 450 Farm. The facility will either be a 900-head capacity or a 1,200-head capacity. These buildings will be funded completely by the Ag 450 Farm and they will be used to finish feeder pigs on contract. If Ag 450 decides to build a new building, they hope to offset the cost of hiring an additional full time farm manager with the income from the building. Another finishing building will also provide an outlet to use the added labor provided by a second full-time employee.

This model is examines the NPV over the lifetime of each proposed building. The lifetime of both projects is estimated to be 25 years with year 0 being the initial investment period. This lifetime was established by information gathered from the Iowa State University Ag Decision Maker website (Lawrence and Ellis 2008). Projected costs and incomes were calculated for each year, providing a total net income at the end of each year. NPV takes all the annual incomes over the lifetime of the building including the initial investment and uses a discount rate to estimate the value of the project. For this model, the discount rate was assumed to be equal to the interest rate that Ag 450 pays the university

for their loan on the barn. There is no annual loan payment included in each year's cash flow due to the discount rate. The model assumes that the initial costs will be paid completely up front. The discount rate accounts for the interest paid on the loan during the projects lifetime (Brealey, Myers and Allen 2014).

5.3 Market Feasibility

To address market feasibility, the main concentration is on income per pig space received on an annual basis. The price per pig space was the main variable for this analysis. To find the minimum price per pig space that the project could withstand, the goal seek method through Microsoft Excel was used.

Because these pigs are fed on contract, the market variable for Ag 450 is the price received per pig space. This puts the 450 farm in a relatively good position because of no need to market the product and thus risk is very low for them. This market analysis examines how much of a decline in price could the Ag 450 Farm withstand to keep a positive NPV. By understanding what that price is, Ag 450 can assess the likelihood of that price becoming a reality.

5.4 Financial and Economic Feasibility

Financial and economic aspects of a new barn will be addressed. The main areas to examine are the variable costs. Fortunately for this project, the main costs are known and fixed but it is also essential to know where the breakeven variable costs are and how they affect the NPV of the project. This analysis examines how high can the variable costs increase before each project experiences a negative NPV.

5.5 Managerial Feasibility

The main variable for management aspect is the labor cost. When looking at managerial feasibility, the amount of skilled labor needed and the management needs to be

identified. This study examines the cost of labor and the breakeven cost before the project would experience a negative NPV. This information can be used to help make a clear decision about whether the project should move forward.

5.6 Repayment Analysis

The length of the repayment period is a concern for the Ag 450 Farm. If it is decided to build a new barn, the loan will be obtained through Iowa State University at 2.89% interest (Vogel 2016). Currently, Iowa State University is expecting 5-year repayment terms but Ag 450 is concerned whether a 10-year repayment is more feasible. By examining the NPV over a set amount of years, it can be determined how many years it will take to bring the NPV to profitability providing insight into the repayment period.

CHAPTER VI: RESULTS

6.1 Base Model Description

A base model was created to determine the economic feasibility. The base model is a general cash flow with project life starting at year 0 and ending at year 25. Year 0 is the initial investment period and assumes the total project cost. The establishment cost is determined by multiplying the total square feet of the project by the pre-determined cost of $30 per square foot.

Annual income is the first line of the model which includes the rental of pig space. Annual revenue was determined by multiplying the number of head per barn by the pre-established price per pig space of $41.

Variable costs include labor, electricity, water, and repairs. Labor was estimated for each model by multiplying the pre-established price of $5 by the total number of head per barn. Electricity was estimated by multiplying the pre-determined price of electricity per head of $4.63 by the number of head per barn. Water costs were estimated in the same fashion by multiplying the pre-determined cost of $2.78 per head by the total number of head per barn. Annual repair costs were estimated at 1.5% of the original building cost each year.

Fixed costs include the initial investment and a 10-year equipment replacement cost. The initial cost for the project is assumed in year 0. An equipment overhaul fixed cost is assumed in year 10 and year 20. As stated previously, this cost was calculated at 30% of the original building costs. This means that 30% of the building is made up of equipment and 70% percent of the building is structure. The figure of 30% of the initial building cost every 10 years was obtained from the Iowa State University Ag Decision Maker website. This cost and timeframe for replacement may vary depending on the quality of equipment

in the building. Lastly, net income is calculated by taking the total income minus the total costs.

Net present value is calculated using a discount rate of 2.89% which is the interest rate of the project loan, net incomes from years 1 through 25, and adding in the original cost in year 0. The base model generated positive NPV's for both sizes of barns. Appendix A is a compliation of the base model NPV and IRR results for the 900-head and 1200-head barn scenarios. Appendix A shows a lifetime NPV of $71,352.81 and an IRR of 5.71% for the 900-head barn. Appendix A also displays a lifetime NPV of $103,103.86 and an IRR of 5.98% for the 1200-head barn. When looking at the base model results, both sizes of barns show positive NPV's and IRR's. If project feasibility was decided soely on NPV and IRR, both buildings would be feasibile and the 1200-head barn would show a slightly higher return on investment. The complete models are found in the appendix.

6.2 Market Feasibility Results

By setting the NPV equal to 0 and changing the cell that contained the price per pig space of $41, minimum price was established. This analysis was completed for both barn projects. For the 1,200-head barn, assuming all other variables stayed constant, the minimum price per pig space received was $36 per pig space. For the 900-head barn, the minimum price per pig space was $37 per pig space. This means that if the annual income per pig space does not drop below these values, each project should be feasible in theory providing that all other variables stay constant.

6.3 Financial and Economic Feasibility Results

For the financial and economic feasibility study, building costs per square foot were examined. This may be one of the most important aspects to consider because if the costs are too high, either project could have a negative NPV from the start. By setting the NPV equal to zero and running goal seek, by changing the cell containing price per square foot of $30, the maximum value that Ag 450 would be able to pay to put up the building can be estimated. For the 1,200-head barn, that maximum value is $36 and the 900-head barn is $36 assuming all other variables stay constant. This shows us that if building costs go up between now and the time of build, Ag 450 could theoretically pay up to $36 per square foot for the project.

The relationship between price per pig space received and the interest rate that the Ag 450 Farm would be paying for the building loan was also considered. A sensitivity analysis was conducted on two important variables, interest rate and return per hog. Though there might be some room for negotiation, these numbers will likely be market determined and outside of Ag 450 Farm's control. Appendix A and Table 6.1 show how

each variable affects one another and could be a useful tool for deciding whether to move forward with the projects or not. Both tables include interest rate on the x axis and price per along the y axis. Each table shows how the project NPV increases or decreases as the return per pig space and interest rate change. Depending on the scenario, the result is either a positive NPV shown in white or negative NPV shown in red.

Table 6.1: Relationship between Price Per Pig Space and Interest Rate for a 1,200-head Finishing Barn

		Intrest Rate									
$103,103.86		**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
	$ 35.00	$ 38,494.24	$ 3,043.78	$ (26,875.14)	$ (52,281.55)	$ (73,987.98)	$ (92,645.18)	$ (108,776.70)	$ (122,805.58)	$ (135,075.22)	$ (145,865.57)
	$ 36.00	$ 64,922.03	$ 26,471.93	$ (5,979.36)	$ (33,535.06)	$ (57,075.25)	$ (77,305.16)	$ (94,792.40)	$ (109,995.85)	$ (123,288.13)	$ (134,973.12)
	$ 37.00	$ 91,349.82	$ 49,900.08	$ 14,916.42	$ (14,788.56)	$ (40,162.51)	$ (61,965.13)	$ (80,808.10)	$ (97,186.12)	$ (111,501.03)	$ (124,080.67)
	$ 38.00	$ 117,777.60	$ 73,328.23	$ 35,812.19	$ 3,957.94	$ (23,249.78)	$ (46,625.10)	$ (66,823.80)	$ (84,376.39)	$ (99,713.93)	$ (113,188.22)
Price Per Pig Space	**$ 39.00**	$ 144,205.39	$ 96,756.37	$ 56,707.97	$ 22,704.43	$ (6,337.05)	$ (31,285.07)	$ (52,839.50)	$ (71,566.66)	$ (87,926.84)	$ (102,295.77)
	$ 40.00	$ 170,633.18	$ 120,184.52	$ 77,603.75	$ 41,450.93	$ 10,575.69	$ (15,945.05)	$ (38,855.20)	$ (58,756.92)	$ (76,139.74)	$ (91,403.33)
	$ 41.00	$ 197,060.96	$ 143,612.67	$ 98,499.53	$ 60,197.42	$ 27,488.42	$ (605.02)	$ (24,870.90)	$ (45,947.19)	$ (64,352.65)	$ (80,510.88)
	$ 42.00	$ 223,488.75	$ 167,040.82	$ 119,395.30	$ 78,943.92	$ 44,401.15	$ 14,735.01	$ (10,886.60)	$ (33,137.46)	$ (52,565.55)	$ (69,618.43)
	$ 43.00	$ 249,916.54	$ 190,468.97	$ 140,291.08	$ 97,690.42	$ 61,313.89	$ 30,075.04	$ 3,097.70	$ (20,327.73)	$ (40,778.46)	$ (58,725.98)
	$ 44.00	$ 276,344.32	$ 213,897.11	$ 161,186.86	$ 116,436.91	$ 78,226.62	$ 45,415.06	$ 17,082.00	$ (7,518.00)	$ (28,991.36)	$ (47,833.53)
	$ 45.00	$ 302,772.11	$ 237,325.26	$ 182,082.64	$ 135,183.41	$ 95,139.35	$ 60,755.09	$ 31,066.30	$ 5,291.73	$ (17,204.27)	$ (36,941.09)

Table 6.2: Relationship between Price Per Pig Space and Interest Rate for a 900-head Finishing Barn

		Intrest Rate									
$71,352.81		**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
	$ 35.00	$ 22,218.61	$ (3,984.21)	$ (26,098.25)	$ (44,877.26)	$ (60,922.13)	$ (74,714.00)	$ (86,639.93)	$ (97,012.58)	$ (106,085.74)	$ (114,066.26)
	$ 36.00	$ 42,039.45	$ 13,586.90	$ (10,426.42)	$ (30,817.39)	$ (48,237.57)	$ (63,208.98)	$ (76,151.70)	$ (87,405.29)	$ (97,245.42)	$ (105,896.92)
	$ 37.00	$ 61,860.29	$ 31,158.01	$ 5,245.41	$ (16,757.52)	$ (35,553.02)	$ (51,703.96)	$ (65,663.48)	$ (77,797.99)	$ (88,405.10)	$ (97,727.58)
	$ 38.00	$ 81,681.13	$ 48,729.12	$ 20,917.24	$ (2,697.65)	$ (22,868.47)	$ (40,198.94)	$ (55,175.25)	$ (68,190.69)	$ (79,564.78)	$ (89,558.25)
Price Per Pig Space	**$ 39.00**	$ 101,501.97	$ 66,300.23	$ 36,589.08	$ 11,362.22	$ (10,183.92)	$ (28,693.92)	$ (44,687.03)	$ (58,583.39)	$ (70,724.46)	$ (81,388.91)
	$ 40.00	$ 121,322.81	$ 83,871.34	$ 52,260.91	$ 25,422.10	$ 2,500.63	$ (17,188.90)	$ (34,198.80)	$ (48,976.09)	$ (61,884.14)	$ (73,219.58)
	$ 41.00	$ 141,143.65	$ 101,442.45	$ 67,932.74	$ 39,481.97	$ 15,185.18	$ (5,683.88)	$ (23,710.58)	$ (39,368.79)	$ (53,043.81)	$ (65,050.24)
	$ 42.00	$ 160,964.49	$ 119,013.56	$ 83,604.58	$ 53,541.84	$ 27,869.73	$ 5,821.14	$ (13,222.35)	$ (29,761.49)	$ (44,203.49)	$ (56,880.90)
	$ 43.00	$ 180,785.33	$ 136,584.67	$ 99,276.41	$ 67,601.71	$ 40,554.28	$ 17,326.16	$ (2,734.13)	$ (20,154.20)	$ (35,363.17)	$ (48,711.57)
	$ 44.00	$ 200,606.17	$ 154,155.78	$ 114,948.24	$ 81,661.58	$ 53,238.83	$ 28,831.18	$ 7,754.10	$ (10,546.90)	$ (26,522.85)	$ (40,542.23)
	$ 45.00	$ 220,427.01	$ 171,726.89	$ 130,620.08	$ 95,721.46	$ 65,923.38	$ 40,336.20	$ 18,242.32	$ (939.60)	$ (17,682.53)	$ (32,372.90)

In both scenarios, increasing price per pig space and decreasing interest rate creates a positive NPV relationship. Likewise, a negative NPV relationship is created when interest rate increases and price per pig space decreases. For example, in Table 6.1 if the interest rate increased to 5%, Ag 450 would need to receive a price per pig space of $40 or greater to result in a positive NPV. In Table 6.2, if Ag 450 was to receive a price of $39 per pig space, and the interest rate climbed to 6%, the project would result in a negative NPV and would not be feasible. On the other hand, if the interest rate in Table 6.2 were to rise to 5%, Ag 450 would have to receive approximately $40 per pig space or greater to keep a positive project NPV.

6.4 Managerial Feasibility Results

In regards to management, the same steps were taken to look at the maximum amount paid for labor. By setting the NPV equal to 0, goal seek finds the maximum amount that Ag 450 could pay for labor while attaining a positive NPV. For the 1,200-head barn, that number is $9.87 per head and the 900-head barn resulted in $9.50 per head. If other variables stay constant, these numbers are the maximum amount per head in labor that the operation could pay before showing a negative NPV over the lifetime of the project.

6.5 Repayment Analysis

For the Ag 450 Farm to consider the repayment period, an analysis was completed on the repayment period. Iowa State University would like a 5-year repayment program. However, the Ag 450 Farm might want to try to extend that period out to 10 years to enable them to have a better cash flow on the project. Also, the fact that the Ag 450 Farm needs to offset some of the additional expense for another full-time farm manager it should be taken into consideration on the repayment period.

Because this model is looking at NPV, there is no annual payment factored into the model as stated previously. The total project cost is assumed in year 0 and the cost of capital or interest rate is assumed within the NPV function. The best way to look at repayment rate would be to examine what the NPV of the project would be after X amount of years. The NPV was run over the first five years to see what the value of the project would be at that point in its lifetime. For the 1,200-head barn, the NPV at 5 years was approximately -$165,500. For the 900-head barn, the NPV at 5 years was approximately -$128,000. These numbers are to be expected as the life of the barn is young and with the annual income of $20-30,000 depending on the barn size, the initial cost would not be paid off yet.

The 10 year NPV of the project values the 1,200- head barn at approximately -$115,000 and the 900-head barn at -$91,000. This is an improvement from the 5 year NPV but still negative. This slight improvement is also because at 10 years there is the lump sum equipment overhaul that is factored in. If the Ag 450 Farm can bypass this overhaul and utilize the equipment that is there, the net present values for the 1,200-head and 900-head barns would be approximately -$47,000 and -$39,000. Again, this would all depend on how much the equipment overhaul costs and if it is needed. Still, without the equipment overhaul factored in, it leaves the project valued in the negative.

To determine the practicality of how long to experience a negative NPV, Ag 450 Farm could use the discounted payback rule. The discounted payback rule asks, how many years does the project have to last for it to make sense in terms of net present value (Brealey, Myers and Allen 2014)? If the total value of the cash inflows over the lifetime of the project never exceeds the initial investment, the discounted payback rule will not accept

that project. However, longer term projects may continue to risk initial rejection if the project is able to withstand the years necessary to achieve a positive NPV.

With an equipment overhaul factored in at 10 years, it is not until year 16 that the 1,200-head barn shows a positive NPV and not until year 17 for the 900-head barn to be in the black. The longer repayment period would be more beneficial from the project value standpoint and would ease the pressure on the annual repayments and be easier on the annual cash flow for the entire farm.

The approximate annual cost for another farm manager is around $60,000 annually (Vogel 2016). Both finishing models do not predict over $60,000 annual revenue. So, a conclusion might be made that although a new finishing barn is predicted to show a positive annual income, it would not cover the total projected cost of another full-time farm manager. It should be considered that there are other sources of revenue that may be able to pay the loan such as the row crop operation, custom farming operation, and the current swine finishing operation. This model was designed to factor in as many different variables as possible and the net annual income may be different depending on the exact numbers at build time. A change in costs and inputs, would change the NPV which would in turn change the effect of the repayment period.

In both the 900-head scenario and the 1,200-head scenario, project lifetime, ability to generate cash flow, market competition and optimism must be considered when looking at whether to reject or accept the payback period. If either barn can generate the projected cash flow for the expected lifetime, and these projections are not unduly optimistic, ISU Ag 450 should be able to accept the longer payback period and be looking at a positive NPV at the end of either project.

CHAPTER VII: CONCLUSION

7.1 Summary of Purpose

The purpose for this research was to examine operation expansion opportunities for the ISU Ag 450 Farm. A focus of the expansion is to increase the amount of custom finished feeder pigs by building another finishing facility. This expansion requires another full-time farm manager. This research has examined the feasibility of expansion of the swine and management to determine what kind of impact this may have on the future viability of the farm.

Methods and procedures were used to examine expansion economic practicality. A project description was completed, followed by data collection, to estimate the models for this study. A long-term project cash flow was developed using the net present value. The internal rate of return, discount payback rule, and goal seek were also used for the analysis. A sensitivity analysis examined the relationship between price per pig space received and project interest rate was conducted. The analysis will aid in the decision-making process for the Ag 450 Farm's method of expansion, which in turn, will provide many more years of success.

7.2 Overview of the Whole Farm

The data of this study shows many similarities between the Ag 450 Farm and the average Iowa farm business. When income statements, balance sheets, and ratios are compared, there are many factors of the ISU Ag 450 Farm near the average for Iowa. There are a few differences however but that is to be expected because the ISU Ag 450 Farm is not a typical farm in the sense that it is run both independently and through Iowa State University.

One benefit of the Ag 450 Farm operation is the labor force. Most Iowa farm businesses do not have 40 or more individuals to help guide the farm. Having such a labor pool allows Ag 450 to use their resources and break the operation up into specified committees that allows the students to capitalize on their interests and talents. Labor on the other hand can be a hindrance as well because the Ag 450 Farm is not the only class students are taking each semester. Many students have their own family farms that need their effort during the spring and fall as well. Managing the labor pool for the Ag 450 Farm is an ongoing task. Thus, there is a desire to hire another full-time farm manager.

Another benefit of the farm is in the management portion of the labor force. Mr. Greg Vogel has years of knowledge and experience at managing the Ag 450 Farm. His passion and desire to help students be the best agriculture managers and decision makers they can be is invaluable. When you tie that with the backing from the Iowa State University Department of Agriculture Education and Studies, it sets the stage for success. Being able to work with Iowa State University gives the Ag 450 Farm an advantage that most Iowa farm businesses do not have regarding borrowing money. The Ag 450 Farm can borrow money internally from the university at lower interest rates than one may find at another lending institution. However, it can be an inconvenience because of the university accounts ending on a June 30th fiscal year and the farm's cash account operating on a December 31st fiscal year. Ag 450 Farm also has several opportunities to do custom work for other Iowa State University entities and continues to capitalize on those opportunities as they present themselves.

From an economic standpoint, the Ag 450 Farm is strong. Financially it matches up with the USDA ARMS data. The main difference in the financial data is the negative net

incomes for 2014 and 2015 that was attributed to the variance of management styles of each class. Most likely, those classes took a conservative approach and grain was not marketed. Those negative incomes could be due to timing of the cash flows. Because Ag 450 runs some of the finances through Iowa State University, some cash transactions do not get included on the current year statement but are added to the following year. This can cause a misalignment in financial statements from year to year. Iowa State University revolving runs on a fiscal year ending June 30th and not a calendar year. The Ag 450 Farm runs their cash accounts on a calendar year so net incomes may be skewed for the Ag 450 Farm. This also skews the ratios.

Overall the Ag 450 Farm looks to be sound financially. Again, when looking at the 2015 balance sheet percentages, the Ag 450 Farm has more assets in land and buildings and less in equipment than the average Iowa farm business. They do have more current debt in operating loans but less accrued interest. As of 2015, Ag 450 does not have any real estate liabilities. Their debt to asset ratio as of 2015 is lower than the average Iowa farm business. Also, their asset turnover ratio is higher than the average Iowa farm business.

7.3 Swine Finishing Barn Conclusions

After looking at the data and results from the swine barn models, either barn looks to be a financially sound investment. Both scenarios result in highly positive net present values over the lifetime of the building. If the lifetime is 25 years, adding skilled labor is not an issue. Investing in another finishing barn proves to be very feasible. As the models show, it will be able to pay for itself in the long run as the net present values indicate. In regards to which size is preferred, if judging by the NPVs and the IRRs for both projects, the recommendation is to build the bigger barn. In the end, the 1,200-head barn has a NPV approximately $30,000 higher. The IRR for the 900-head barn was 5.71% and the 1,200-

head barn was 5.98%. In the current state, the Ag 450 Farm proves to be financially stable enough to take on a project like this. Risk is also lowered as they are contract feeding instead of producing on their own. Market volatility is virtually eliminated and variable cost volatility is minimal.

Manure management should be considered when building either swine barn. The Ag 450 Farm has enough land to handle the manure associated with the 900-head barn but would need to find additional land to apply manure on to accommodate the 1200-head barn. Barn odor is another factor that must be studied. Due to the proximity of the Ag 450 farm to the city of Ames, obtaining a permit to build another swine facility may be difficult because of odor concerns. Finding a location to build the barn that is further away from town may have to be considered. Lastly, the nutrient value of the manure produced by either barn should be considered by the Ag 450 Farm and could be added to the model for greater accuracy.

7.4 Additional Farm Manager Conclusions

One of the questions of this research centered around the feasibility of the farm adding an additional farm manager. This question was addressed throughout this study. The Ag 450 Farm will hire another full-time farm manager if either barn is built. Depending on annual costs and repairs, the buildings could be paid off anywhere from approximately 12 to17 years into their life. Positive NPV on the barns may come sooner based on the actual costs that the Ag 450 Farm incurs.

There are other aspects to consider when looking at another manager. His or her responsibility will not be solely to manage the finishing barn suggesting that the barn should not cover the total cost. Ag 450 will also be gaining another source of labor that may increase total farm efficiency. Overall, Ag 450 looks to be financially to afford another

manager if the barn is built. A 1,200-pig barn will require every day management and a new consistent labor source will be needed. It is logical to hire somebody that not only can manage the new barn but have the skills to assist with other operations and student guidance and teaching activities.

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APPENDIX A

Base Model NPV and IRR Results

Year		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Annual Income																											
Revenue			$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900
Variable Costs																											
Labor			$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500
Electric			$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163	$4,163
Water			$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498	$2,498
Repairs			$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456
Fixed Cost																											
Initial Investment		$230,400																									
10 Yr. Equip. Replace												$69,120										$69,120					
Total Variable Costs			$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616
Total Fixed Cost			$0	$0	$0	$0	$0	$0	$0	$0	$0	$69,120	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$69,120	$0	$0	$0	$0	$0
Total Costs			$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$83,736	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$14,616	$83,736	$14,616	$14,616	$14,616	$14,616	$14,616
Total Income			$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900	$36,900
Total Net Income		-$230,400.00	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	-$46,836.00	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	$22,284	-$46,836.00	$22,284	$22,284	$22,284	$22,284	$22,284
NPV	$71,352.81																										
IRR	5.71%																										

Year		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Annual Income																											
Revenue			$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200
Variable Costs																											
Labor			$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000
Electric			$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550	$5,550
Water			$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330	$3,330
Repairs			$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536	$4,536
Fixed Cost																											
Initial Investment		$302,400																									
10 Yr. Equip. Replace												$90,720										$90,720					
Total Variable Costs			$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416
Total Fixed Cost			$0	$0	$0	$0	$0	$0	$0	$0	$0	$90,720	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$90,720	$0	$0	$0	$0	$0
Total Costs			$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$110,136	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$19,416	$110,136	$19,416	$19,416	$19,416	$19,416	$19,416
Total Income			$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200	$49,200
Total Net Income		-$302,400	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	-$60,936	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	$29,784	-$60,936	$29,784	$29,784	$29,784	$29,784	$29,784
NPV	$103,103.86																										
IRR	5.98%																										