COMPARATIVE GRAIN STORAGE ANALYSIS

by

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ABSTRACT

Grain Elevators have towered the plains of Southwest Kansas for over the last half of a century. Many of these large white concrete structures were built during the 1950s using a slip form concrete design. While new grain storage has been built over time, many of the original slip form structures remain a large part of the farm cooperatives storage capacity. Grain production has continued to increase and put greater demand on storage facilities and handling capabilities. Thus, there is a need for cooperatives to meet the future demands of farmers by replacing or updating grain storage assets.

The objective of this project is to provide a comparative analysis of grain storage options that a cooperative, primarily the Garden City Co-op, Inc. (GCC), could utilize in making a decision to update or replace grain storage assets. The project examines three different options for grain storage including concrete, steel, and bunker storage. The project will also examine extending the life of an original slip form elevator by installing a gunite bin liner. To determine which option that provides the most economic benefit to GCC and its members, Net Present Value and the Internal Rate of Return are estimated for each grain storage option.

GCC historical grain handling margins and grain storage costs were derived from historical averages and bids from projects GCC has undertaken in the past five years, respectively. The model assumes receipts as a percentage of storage to accurately represent bushels handled by a facility. Grain storage is highly variable in initial cost and the operational needs will change in every circumstance. The results indicate that a large volume of grain is needed before economic profits will be realized.

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CHAPTER I: INTRODUCTION

1.1 Introduction

Grain Elevators have towered the plains of Southwest Kansas for over the last half of a century. Many of the large white concrete structures were built during the 1950s using a slip form concrete design. While new grain storage has been built over time, many of the original slip form structures remain a large part of the farm cooperatives storage capacity. Grain production has continued to increase, which has put greater demand on storage facilities and handling capabilities. Thus, there is a need for cooperatives to meet the future demands of farmers by replacing or updating grain storage assets.

The objective of this project is to provide a comparative analysis of grain storage options that a cooperative, primarily the Garden City Co-op, Inc. (GCC), could use in making a decision to update or replace grain storage assets. The project will examine three different options for new grain storage including concrete, steel, and bunker storage. The project will also examine maintaining an original slip form elevator that has surpassed its useful life by evaluating a gunite bin liner. Gunite bin lining is the process of reinforcing a bins interior structure with rebar and a gunite mixture that is similar to concrete.

There are grain storage assets that have outlived their useful lives and without proper maintenance or replacement could lead to structural failure. The most dramatic example of an elevator surpassing its useful life was the collapse of the Agco grain elevator in Russell, Kansas that claimed two lives. While there is not a predetermined length of years that grain storage asset will last, many of the grain storage facilities are fifty to sixty years old. Structural integrity is not necessarily just the number of years, but it is the combination of years, amount of use, and maintenance that has taken place (Bickel 2010).

It is essential to understand that an elevator will not last forever without proper maintenance and upgrades including replacement.

The demands of the country elevator have continued to increase with higher yields and the increasing speed and efficiency of the farmers harvesting equipment. Grain yields, particularly corn, have continued on an upward trend. This has put significant pressure on country elevators ability to store and handle the crop within the design capabilities of many storage facilities that were built in the 1950s. This increase in use of elevators can put additional stress on the structural integrity of the bin. The more a bin is turned may result in a shorter life. Cooperatives hold a responsibility to meet their member farmers' expectations of planning for the future and replacing assets that have served their useful life. Meeting the expectations of the farmers will provide the cooperative a competitive advantage.

1.2 Garden City Co-op, Inc.

GCC is a farmer owned cooperative located in Southwest Kansas. It operates grain elevators at 17 different locations, most being slip form concrete elevators built in the 1950s. Over the years, GCC has been proactive in adding grain storage and updating facilities. In the late 1970s, it built a new slip form concrete elevator in Deerfield, KS. In the late 1990s, it made three expansions to existing elevators with jump form concrete construction at Lowe, Pierceville, and Friend, KS. In 2010 and 2011, it expanded three locations Deerfield, Shields, and Wolf, KS with jump form concrete (Figure 1.1). This proactive approach has left GCC in a good position to continue its commitment to the member owners. Moreover, this planning for the future has made it possible to avoid a crisis point where all elevators need instantaneous attention at the same time.

In the summer of 2012, GCC had a firsthand experience of a Concrete elevator's useful life coming to an undesirable end. The Wolf elevator had a bin failure (Figure 1.2). After that failure, the engineers and structural repair company informed GCC the entire annex in which the bin was located was not structurally sound. The Wolf annex was built in 1953. This prompted GCC to put an emphasis on taking a proactive approach to the future of serving the members with grain storage facilities.

This project is intended to assist GCC in navigating through the process of planning future expansions and grain storage replacement. The project seeks to provide a clear answer as to what type of grain storage solution is the most desirable for a given situation. The thesis will not only be useful to GCC, but the analytical model will be useful to all cooperatives facing the same challenges regarding which of the three grain storage options concrete, steel, or bunkers, best fits the need, along with the feasibility of extending the useful life of a 1950s slip form elevator with a gunite liner.

Figure 1.1: Decade of Concrete Construction and Bushel Capacity of GCC Grain Facilities

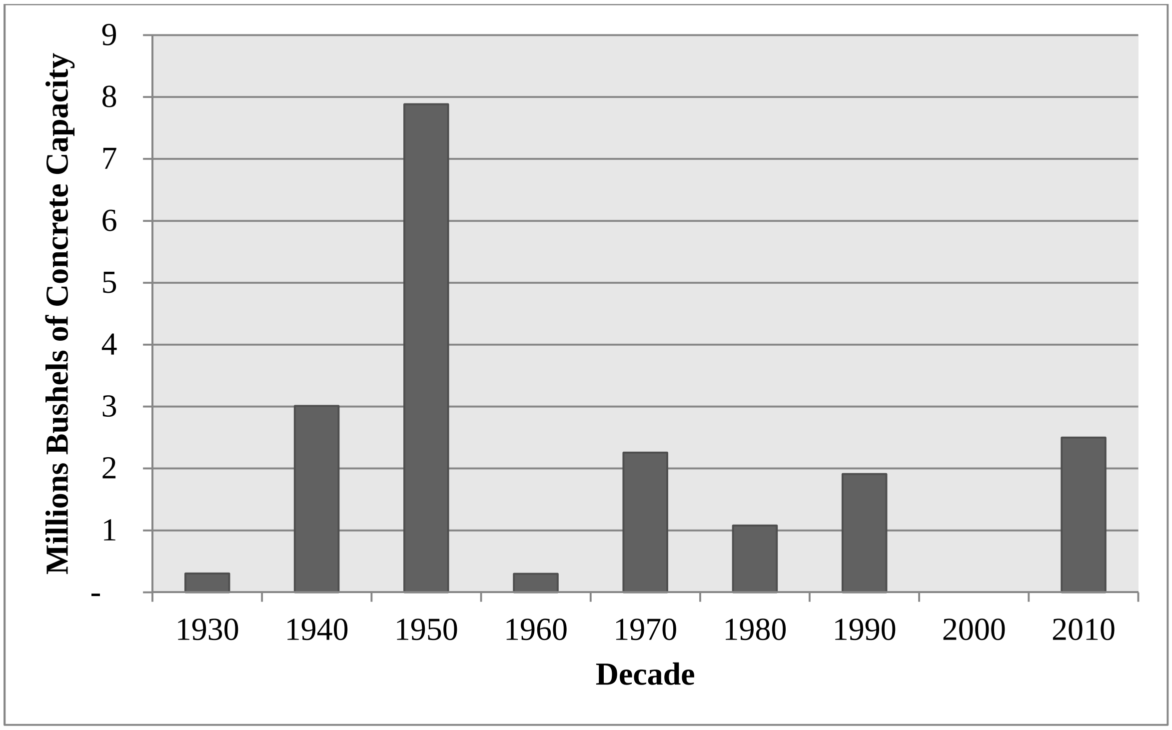

Figure 1.2: Wolf Elevator Bin Failure

CHAPTER II: LITERATURE REVIEW

The literature addressing aging grain elevators structures in the Midwest is limited. No literature was found on investment analysis for the replacement of grain storage assets under cooperative ownership. The literature available on commercial grain storage puts a large emphasis on grain handling and storage cost rather than investment analysis.

In the article entitled "Use of Net Present Value Analysis by Electric Cooperatives", Johnson, Smythe, Fulmer (2000) argue that the use of Net Present Value (NPV) analysis would be beneficial to the cooperative members as much as it would be to stockholders of a for profit corporation when determining which projects to select. While an electric cooperative is not identical to a farmer cooperative, the general or broad structure of the cooperative model is similar. In both cases, a cooperative or a public corporation, the equity holders expect to benefit from the company's business activities. Stockholders in a public company expect to receive dividends or stock appreciation; cooperative members expect to benefit from price advantages or patronage distributions. Public corporation and cooperatives alike both seek to meet the expectations of their equity holders. This makes a strong argument for the use of NPV analysis by a cooperative when making a decision on which projects to invest in to maximize wealth of the members.

Johnson et al,. (2000) points out two complications that can occur when NPV analysis is used by cooperatives, one determining the cost of equity capital and two cooperatives taxation. The cost of equity capital must be determined when using the NPV analysis. This can be difficult for a cooperative when determining the members required return or opportunity cost. Secondly the tax situation of a cooperative is different from that of a public corporation in that taxes on portions of income earned from patronage are handled differently than that from non-patronage sources. If a given projects' earned income comes entirely from one source, the after tax cost of debt is not nearly as difficult to determine. If earned income from a project comes from both sources it is more difficult to determine. The authors conclude that, "the use of NPV analysis is an extremely valuable tool that can be used by cooperatives to make optimal decisions about project selection" (Johnson, Smythe and Fulmer 2000).

Chapter five of the book "Principles of Corporate Finance" discusses three main investment analysis criteria; NPV, Internal Rate of Return (IRR) and Payback. With regards to investment criteria, the authors point out "Any investment rule that does not recognize the time value of money cannot be sensible" (Brealey et al,. 2011, pg 103). This is a concern with using the payback rule as investment criteria. The payback method disregards the time value of money and any cash flows after the specified time frame. There is also evidence that it is difficult to use the IRR investment criteria alone without using NPV. In determining elevator projects, it would be difficult to use IRR alone because there is a potential that a project would be selected that does not provide the highest wealth maximization for the members when projects are mutually exclusive.

Commercial grain handling cost is a crucial component of any investment analysis of new grain storage or updating existing storage. Kenkel (2008) examined grain handling cost at country elevators and provided cost estimates on a per bushel basis for corn, soybeans, and wheat (Table 2.1). It was discussed historically that the break down between fixed and variable grain handling costs to be two thirds fixed and one third variable. If an elevator's goal is to lower the overall total cost per bushel, an important way to do so is to increase the bushels handled. Kenkel (2008) concluded that variable cost had become a larger component of handling cost. Grain shrink was determined to become a much larger factor as grain prices increase. This increases the need to become more concerned with improving handling processes to reduce grain shrink.

Table 2.1: Grain Handling Cost ($/Bushel) at 2008 Grain and Electricity Cost

	Corn	Soybeans	Wheat
Moisture and Shrink	$0.1170	$0.1590	$0.1130
Electricity	$0.0100	$0.0100	$0.0450
Fumigation	$0.0080	$0.0000	$0.0230
Total Variable Cost	$0.1340	$0.1690	$0.1800
Salary and Benefits	$0.0720	$0.0720	$0.0720
Insurance and Maintenance	$0.0350	$0.0350	$0.0350
Other Fixed Cost	$0.0380	$0.0380	$0.0380
Total Fixed Cost	$0.1450	$0.1450	$0.1450
Total Cost/bushel	$0.2800	$0.3140	$0.3300
% Increase 2005-2008	39%	40%	25%

Assumes corn price = $6.00, soybean price = $12.75, wheat price = $7.50, and electricity cost = $.0967/KW

Source: (Kenkel 2008)

Baumel (1997) studied grain elevator handling cost over a two year period of 10 different elevators in Iowa. From 1993-94, total cost per bushel handled ranged from $0.118 to $0.214 and for 1994-95 total cost ranged from $0.084 to $0.129. The study's purpose was to determine the relationship between the volume of grain handled and cost of grain handled. It was determined that an increase in the volume of grain also increased cost but not proportionally. It was concluded, "few, if any, grain handling costs vary in direct proportion with bushels handled" (Baumel 1997, pg 2). Grain handling costs per bushel have an inverse relationship with volume. Increasing the volume of grain handled is the easiest way to decrease per bushel cost. Understanding the inverse relationship of cost to bushels is imperative when accurately measuring the potential return of investment.

Dhuyvetter (2007) examined the cost of on farm storage and determined that economies of size are particularly apparent in the cost of initial investment as they would be in commercial grain storage. He discussed that there was high variability in the initial cost. This high variability in initial cost is due to many variables including grain storage capacities, equipment, size and speed of equipment, and overall design. The scale of which to consider a grain storage investment is on a per bushel basis. Dhuyvetter (2007) also highlighted why a farmer may want to invest in on farm storage. Cooperatives could view this as a reason to invest in updating grain storage and elevator replacement for the same reasons. A few of those reasons being having storage space available, to avoid long truck lines (bottlenecks) at facilities and give the farmers fewer reasons to invest in their own on farm storage.

These articles coupled together provide a sound framework to gain an understanding of investment analysis, the cost structure of grain handling for a country grain elevator, and the cost of an initial investment of grain storage assets. Valuable information was obtained from each piece of literature. That information will be used as a guide in this project.

CHAPTER III: THEORY AND CONCEPTUAL MODEL

A farm cooperative's goal is to maximize member benefits. These benefits range from patronage, competitive prices, and services. In the case of services, they create value for the members because these services are funded partially through members' equity. Equity should be used by cooperatives as a scarce resource and managed in a way to yield an investment return to the member. Therefore, projects that create value for the patrons should also create a return on investment. Investment in updating or replacing grain storage should be selected not only by that creates the most value to the producer, but also on which creates a return on investment. The theory used to analyze each grain storage option is the Net Present Value rule (NPV) and Internal Rate of Return (IRR). The two investment rules compare the future expected profits of each project against what other projects could be undertaken.

3.1 Net Present Value

NPV is the process of discounting all future cash flows (C) in time period (T) over the life of an investment back to today's dollar value. The expected cash flows are discounted at the rate of the opportunity cost of capital (r).

$$\mathbf{NPV = -C_0 + C_1/(1+r) + C_2/(1+r)^2 + \ldots + C_t/(1+r)^t}$$

Time period 0 is the initial investment; all cash flow throughout the useful life of the investment includes all revenues and costs the investment will incur. Discounting the cash flows is the process that accounts for the time value of money. Since a dollar invested today could begin earning interest, a dollar tomorrow is not worth a dollar today. GCC could allocate farmers equity to different investments. GCC should insure that investments be considered that have the highest NPV and create value through serving the patrons.

Using NPV as a rule and accepting projects with an NPV greater than 0 on future cash flows of projects being considered is a tool that can assure that a proper return on the farmers' investment in the cooperative is being achieved. When NPV is greater than 0, the investment is generating real economic profits that achieving a higher rate of return than the opportunity cost of capital.

3.2 Opportunity Cost of Capital

To use NPV, the opportunity cost of capital (r) for the cooperative has to be determined. The opportunity cost of capital is essentially the opportunity cost to the cooperative. It is the rate the cooperative could invest in and return what it would earn. To determine this rate, the weighted average cost of capital (WACC) method is used.

$$\mathbf{WACC = K_e W_e + K_d (1-T) W_d}$$

Calculating the WACC requires the return on equity (K_e), the equity to asset ratio (W_e), the cost to borrow debt funds (K_d), the tax rate (T), and the debt to asset ratio (W_d).

3.3 Internal Rate of Return

IRR is an investment rule that considers all cash flows of an investment and returns the discount rate that would make the NPV of a project 0. This assumes that an investment should be accepted when the IRR is above the rate of the opportunity cost of capital. IRR needs to be used along with NPV when comparing projects because the highest IRR does not necessarily result in the highest NPV.

$$\mathbf{IRR = -C_0 + C_1/(1+irr) + C_2/(1+irr)^2 + \ldots + C_t/(1+irr)^t = 0}$$

IRR is an investment analysis tool that works well in a cooperative. Discussed earlier the highest NPV should be selected that also creates value for the member owners. Maximizing member benefits as a whole is the goal of GCC and while financial return is one part of that, service and competitive pricing are also a large part. NPV may not be positive on projects that are providing service and more competitive prices to the members, but the project still must cash flow. Therefore, IRR is another tool GCC can utilize to determine if the return is high enough to accept a project.

3.4 Sensitivity Analysis

Sensitivity analysis is performed on each option to analyze the effects that different variables have on the financial outcomes of grain storage investment. Through this analysis, the project will gain insight on which variables pose the largest risk to success or failure of the investment. Multiple scenarios will be conducted on variables such as quantity of grain handled, fixed labor cost, and gross margins. A comparative analysis using NPV and IRR investment rules will be coupled together with sensitivity analysis to assist GCC in making an informed estimate of the return on investment of grain storage projects.

CHAPTER IV: METHODS

The objective of the thesis is to accurately estimate the real economic value of each grain storage option for GCC. Many variables can influence the outcome of the results, therefore, sensitivity analysis was conducted. The large risk posed to GCC is drought and irrigation water supply deteriorating.

The data for this project were collected directly from GCC. The exception is the construction bids received from outside contractors, and the insurance rates received from KFSA (Kansas Farmers Service Association). The bids from contractors were for either current grain storage projects or future projects. Projects completed by GCC in the past five years were also used to determine the cost of building grain storage and updating equipment. GCC's five year average grain handling cost and margins are used as the baseline figures in each of the different grain storage options. Grain receipts are based on the capacity of grain storage. The receipts are based on historical GCC data from the country elevators.

4.1 Construction Bids

The bids were based on completed and future projects being reviewed by GCC. One exception was the steel grain storage construction. GCC has not built a steel grain storage facility; therefore this bid was estimated by an industry professional based off prior construction knowledge. When determining the per bushel cost of construction, economies of size are important. The larger the grain storage bin constructed, the per bushel cost of construction decreases. Averages derived from the high and low bid are used in each of the models (Table 4.1). The bunker bid includes all equipment and dirt work associated with the construction. The gunite bid only updates the structural integrity of the current bin and has no other cost associated with it. Both steel and concrete bins have new grain handling equipment, electrical, temperature cable, aeration control, dirt work, and ground analysis costs associated with the construction. The concrete and steel grain storage are comparable in the associated costs; thus an assumption is made that all costs excluding bin construction are the same. The main difference is that legs constructed with concrete storage are secured to the concrete bin, but that is not possible with steel construction.

Table 4.1: Per Bushel Cost of Grain Storage Construction

	Low	Average	High
Concrete	$2.01	$2.13	$2.25
Steel	$1.50	$1.90	$2.30
Bunker	$0.29	$0.35	$0.41
Gunite	$2.83	$3.07	$3.31

Grain handling equipment costs are highly variable. Costs are dependent on many factors but the main influences are the speed and distance that grain will be moved. This also has an influence on the electrical costs. The larger the horsepower the motor, the more it will cost. The cost difference between building equipment that transfers grain vertically or horizontally is not generally different. Grain handling equipment costs can be upwards of 50% of total construction cost.

Electrical cost can also be highly variable depending on the grain handling equipment installed. The current electrical system and what the power supply company has in place also have an impact on cost. Electrical work is determined as an average for the comparative analysis of each grain storage option.

Temperature monitoring and aeration controls are not highly variable and make up a small percentage of total construction cost. The cost to GCC has ranged from $0.05 to $0.09 per bushel of capacity constructed.

Ground excavating and analysis are dependent on current roads already established, accounting for a small percentage of total construction costs. This cost for GCC has ranged from $0.01 to $0.09 per bushel of capacity constructed.

Miscellaneous and contingency cost have been low for GCC when building new storage or updating current storage, therefore, in each model an assumption of 0.50% of the sum of all other costs for the miscellaneous cost.

Construction costs are highly variable dependent upon whether new construction is an expansion to a current facility or a green field site. The speed, size of equipment, and the different construction options all determine the actual cost. Averages are used to compare each grain storage option. GCC currently has a green field construction project ongoing that is analyzed in the comparative analysis. This green field site is being constructed using concrete and is analyzed using the actual costs.

4.2 GCC Gross Margins and Grain Handling Cost

All gross margins and costs associated with grain handling and storage are derived from five year averages except for insurance on new storage. Gross margin and variable cost are based on grain that is received and grain that is sold. Fixed cost is based off per bushel of licensed capacity of the grain storage. Insurance cost for new storage was obtained from KFSA which is the provider of insurance for GCC and is based on a $5,000 deductible. Insurance cost on current grain storage and gunite was obtained from a five year average. The reason for this difference is it is difficult to accurately determine the values of existing storage and equipment. This does not have a large impact on results.

Basing fixed cost off of licensed storage capacity rather than bushels handled provides a more accurate representation. Fixed cost does not change due to an additional bushel handled. It is based off licensed capacity of storage that is constant. The fixed cost includes property tax, licenses, permits, and insurance. Insurance is based on the value of the assets and grain with new storage as well as licensed capacity for current storage and gunite. Similarly, Kenkel (2008) based fixed cost on grain handled.

Variable cost is based off of grain handled as each additional bushel increases the cost. The variable costs are assumed to be linear with handled bushels. Variable costs include utilities, repairs and maintenance, plant supplies, safety and compliance, and other miscellaneous items.

Labor is a split between fixed and variable because GCC employs some people at each full season elevator whether grain is received or not. Management at GCC believes that this ratio ranges from 20% to 30% variable with the remainder being fixed. Labor costs are estimated from the five year average of costs for the licensed capacity (fixed portion of labor) and the total bushels handled (variable portion of labor). The fixed portion of labor for bunkers is assumed to be half of that of all other storage, because additional full time labor would not be hired for a bunker. Bunkers have a higher variable cost. GCC pays an outside party a cost of 0.025 cents per bushel to fill and 0.035 cents per bushel to empty.

Grain handling shrink is based off of a $6.00 shrink price. This was the three year average closing bid at the GCC Ulysses branch for all grains. This price assumption could have an effect on results if grain prices were to change significantly. Grain companies have some leeway on the date they account for shrink and is based on the purchase price. Shrink becomes a larger part of variable cost as more grain is handled and if prices increase. The historical GCC fall harvest shrink percentage is used, which is 0.75% of total receipts. The exception is for a bunker that is a shrink of 1.25% of total receipts. The reason for this difference is the storability of grain in bunkers is not the most efficient method and is subject to more shrink. With the terminal having high expertise in storing grain in bunkers, it is assumed that GCC would fall into the high end due to less experience with bunker storage. Note that the shrink percentages are high so as to be conservative.

4.3 Financing, Opportunity Cost of Capital, Depreciation and Tax.

The cost of financing is determined by using the WACC which includes the cost of debt funds. The cost of debt was determined to be 5.25% with a tax rate for GCC being 42%. The cost of equity capital was determined by using the five year average of GCCs total savings to determine the return on equity (ROE) of 19.62%. The capital structure ratio five year averages was 51% debt to asset ratio and 49% equity to asset ratio. The WACC was calculated to be 11.20% or **(19.62%*49%) + (5.25 %*(1-42%)*51%).**

The depreciation for each of the grain storage options is ignored except for the green field concrete option. The reason is because the cash flows from each project are assumed to be 100% patronage based income and distributed on a 100% allocated basis. Therefore, all other grain storage options will not affect taxes of the cooperative.

The green field concrete will be owned by another GCC entity and will be leased back to the cooperative, which causes GCC to account for depreciation, since this entity is taxable. The green field concrete storage uses 7 year depreciation. Depreciation can be used to offset nonmember income under the entity that owns the green field concrete, a tax savings to the cooperative. The model assumes that there is enough taxable income for the project to provide the tax savings. A 42% tax rate is used to calculate the tax saving from depreciation.

4.4 Grain Receipts and Bushels Handled

Grain receipts and bushels handled are important variables in the results of the NPV and IRR analysis. GCC can view which storage is being used most based off of its capacity and grain volume or more specifically dividing the grain receipts by total capacity. Based off GCC current operations elevators have been turned 1.5, 2.0, and 2.5 over the last ten years at some locations on average. These three scenarios are used to help determine the quantity of grain needed before investing in a project.

GCC would not be interested in additional grain storage if receipts were to be less than theses turn percentages. This will measure the economic efficiency of the grain storage. Each grain handling option uses a capacity of 1,000,000 bushels; the green field concrete uses the actual capacity which is 1,044,285. Bushels handled are equal to receipts plus bushels sold. It is assumed every bushel received by the grain storage is sold, thus making the bushels handled 2 time receipts.

The comparative analysis of the different types of grain storage is based on many assumptions. It is likely that the averages will not fit every single case (that is why the "what if" scenarios are examined). The concrete storage on a green field site is examined to gain a greater understanding of the economics of grain storage construction for GCC.

4.5 NPV and IRR Model

The NPV and IRR are estimated based on annual cash flow and costs. The model assumes that each grain storage asset has a 30 year life. Concrete storage will likely last for a longer period, and steel and bunkers may begin to falter by this point. At 30 years, it would be assumed that some grain storage may begin to incur higher maintenance costs. Another key assumption in Southwest Kansas is projecting future production out 30 years.

Many issues arise in the long term such as innovations, production methods, drought, and water sources.

The analytical model was created in Excel and is broken into three main parts. The first portion models the initial cost of the grain storage option. The costs are in dollar amount per bushel of storage capacity (Table 4.2). The second portion of the model includes all of the variables associated with the analysis (Table 4.3). This is where the input data are located and where all the factors that influence the model are located. The third portion is the actual working portion of the model that estimates the NPV and IRR results (Table 4.4). In this section, for each variable, actual cost to the storage option is derived by using the appropriate variable in the input section. The gross margin is derived and costs are subtracted to provide the estimated cash flow. Then NPV and IRR are estimated by using Excel formulas over the 30 years of cash flows. Each storage options' model can be found in the appendices.

The model does not include growth factors. This assumption is used to simplify the model and to focus on the relationship the variables have on grain storage. Another justification for the lack of a growth factor is that future grain production could decline with drought and decreasing irrigation, which would be offset by higher margins.

The model was also used to estimate the PV (present value) of existing grain handling assets GCC currently operates. That is, the present value of all existing GCCs, elevator's future cash flows, under the above assumptions, are estimated. This was done to assist GCC in analyzing which current location it would be suitable to invest in and which ones may need to be avoided.

It should be noted that this PV estimation has a number of assumptions built into the analysis. First, a 10 year life and no initial cost is assumed. Second, the model does not assume any cash flows from grain being transferred between locations. Third, the 10 year PV analysis assumes that each location is a fully staffed elevator which is not the case, seasonal elevators would not stand a full labor cost. Fourth, grain margins are assumed to be average at the locations that do not fill to capacity, which may not always be realistic. The elevators that do not fill to capacity will most likely receive the most margin per bushel due to GCC's ability to hold grain until market conditions are ideal. Finally, the PV model used each location 10 year average receipts as a percentage of capacity.

Table 4.2: Concrete Expansion Model Initial per Bushel Cost

Initial Cost	**Per Bu**
Concrete	$2.10
Equipment	$1.76
Electrical	$0.30
Temp and Aeration Controls	$0.07
Ground Analysis and Work	$0.04
Miscellaneous	$0.02
Total	**$4.29**

Table 4.3: Concrete Expansion Data and Variables

Variables	
Shrink Price	$6.00
Size of New Storage	1,000,000
Total Initial Cost	$4,290,000
Receipts of Storage Capacity	150%
Through put (Handled)	2
Life of Investment	30
Opportunity Cost of Capital	11.20%
Average Gross Margin	$0.2180
Personnel Cost	
Fixed Per Bu of Storage	$0.1493
Variable Per Bu of Handled	$0.0187
Fixed	**Per Bushel of Storage Capacity**
Property Tax	$0.0198
License and permits	$0.0017
Insurance Building Per $1000	$1.7600
Insurance Grain Equipment Per $1000	$8.6900
Insurance Stock Per $1000	$0.7400
Operating	**Per Bushel Handled**
Utilities	$0.0174
Repairs and Maintenance	$0.0041
Plant Supplies	$0.0015
Safety and Compliance	$0.0011
Other	$0.0187
Shrink % Receipts	0.75%

Table 4.4: Concrete Expansion Working Portion of Model

Year	**0**	**1**	**30**
Bushels Handled a Year		3000000	3000000
Gross Margin		$654,000	$654,000
Personnel			
Fixed		($149,300)	($149,300)
Variable		($56,100)	($56,100)
Fixed			
Property Tax		($19,800)	($19,800)
Insurance		($25,650)	($25,650)
License and Permits		($1,700)	($1,700)
Operating			
Utilities		($52,200)	($52,200)
Repairs and Maintenance		($12,300)	($12,300)
Plant Supplies		($4,500)	($4,500)
Safety		($3,300)	($3,300)
Other		($56,100)	($56,100)
Grain Shrink Cost		($67,500)	($67,500)
Cash Flow		$288,490	$288,490
Initial Investment	($4,290,000)		
Net Cash Flows	($4,290,000)	$205,550	$205,550

NPV	**($2,530,690)**
IRR	**2.52%**

4.6 Sensitivity and "What If Analysis"

Sensitivity analysis was performed to gain a greater understanding of the affect key variables have on the results. Grain receipts were changed as a percentage of the storage. The base model assumed receipts to be 150% of storage capacity. GCC would not likely be interested in grain storage investment if receipts were expected to be less than 150% of storage. The percent of receipts were varied from 150% to 200% and 250%.

Further analysis and scenarios were completed using "what if analysis" on the base model cost and margin to determine the percent of capacity needed to make the NPV of each storage option 0. Analysis was done to determine what the gross margin has to be to make the models NPV equal to 0, each storage option using 3 different receipt scenarios 150%, 200%, and 250%. A limited irrigation scenario is simulated to examine the effect absent irrigation could have on each storage option by allowing for receipts to be 100% of capacity such that there may only be one significant harvest per year and that being wheat. Allowing for 100% receipts also gives insight to building a grain storage addition at a location that yields a lower turn percentage than the base model.

Drought is a large risk in Southwest Kansas. GCC includes a drought factor in every investment analysis. Drought was analyzed by determining the effect it will have on the results of each option. This was done by setting the first 3 year receipts of each storage option to only 75% of capacity. Then the remaining 27 years were 150%, 200%, and 250% of capacity. Since the cash flows in the beginning of a NPV model are weighted more heavily than further out, drought has the largest potential to affect the results negatively in the beginning. Drought at the end of the investment would have a less negative effect on the NPV and IRR. These scenarios were to test the effects some variables that may not remain constant could have on the success of each option.

CHAPTER V: RESULTS

The results from each option and scenario give significant insight into the economics of grain storage. This insight is a guide in determining which options are best for GCC to invest in. Furthermore, the results assist in identifying when it is suitable to use gunite to repair an elevator or expand an elevator. Determining when to abandon use of a current elevator is not determined by the results. From an economic standpoint determining when to abandon an elevator would be when the cost to keep it operational becomes so great that the annualized NPV of building new is greater than the annualized value of the existing storage. From an engineering and safety standpoint the cooperative would need to abandon or check the feasibility of gunite when the risk of bin failure becomes too great that it surpass the cooperatives threshold for structural collapse risk.

The base model results were reported for each grain storage option using three levels of capacity use, 150%, 200%, and 250% (Table 5.1). In the base models only the bunker and gunite options achieve a positive NPV. Except for the green field concrete before tax all options have a positive IRR. The green field concrete before tax savings is negative at the 150% capacity use level.

Table 5.1: Base Model NPV and IRR Results at 150%, 200%, and 250% Receipts of Capacity Levels.

Results	Concrete	Steel	Bunker	Gunite	Green Field Concrete Before Tax Savings	Green Field Concrete After Tax Savings
Capacity	1,000,000	1,000,000	1,000,000	1,000,000	1,044,285	1,044,285
Initial cost per bu	4.29	4.09	0.35	3.09	7.15	7.15
NPV at 150%	($2,530,690)	($2,479,233)	$75,703	($1,254,939)	($5,770,020)	($2,872,279)
IRR at 150%	2.52%	2.22%	13.91%	5.58%	N/A	3.45%
NPV at 200%	($1,402,779)	($1,376,741)	$553,726	($108,027)	($4,592,158)	($1,694,418)
IRR at 200%	6.76%	6.62%	30.06%	10.75%	2.06%	7.07%
NPV at 250%	($274,867)	($274,250)	$1,031,749	$1,038,886	($3,414,297)	($516,556)
IRR at 250%	10.37%	10.33%	45.95%	15.40%	4.78%	10.02%

N/A IRR cannot be calculated

The concrete storage option would be a concrete expansion project for GCC elevators. The base concrete model never has a positive NPV (-2.5 million to -275,000). The IRR in each scenario is positive and represents the discount rate that yields an NPV of 0. At 150% and 200% capacity use the NPV is extremely negative at $2,530,690 and $1,402,779. When capacity use reaches the 250% the IRR is 10.37% and a much less negative NPV is realized at a negative $274,867. With an IRR of 10.37% being just below GCC WACC, it is possible this project may be acceptable to the GCC board of directors because the project would provide significant service to the membership.

The steel storage option is also a possibility for a storage expansion; it maintains a NPV very comparable to concrete. At all levels of receipts to capacity, the NPV of steel never becomes positive. Furthermore, the NPV of steel remains slightly less negative than the base concrete primarily because steel has a much lower initial investment cost.

When comparing concrete to steel grain storage facilities, concrete is the best choice for GCC. The primary reason is because the steel IRR is always lower than the concrete IRR. Furthermore, 30 years would be close to a maximum life for steel storage; however, concrete would have a very high probability of surpassing 30 years based off of the history of concrete structures. Finally, concrete storage also creates larger annual cash flows due to the lower fixed cost such as insurance.

The Bunker has a positive NPV at each receipt level but increases slower as capacity use increases compared to all other options due to the higher variable cost of labor. The bunker yields the highest IRR at each capacity use level but does not yield the highest NPV at the 250% level. The bunker option for GCC from an operation standpoint would not be turned 1.5 (150%), 2.0 (200%), or 2.5 (250%). The reason for this is because bunkers would have to be filled 1 time and then emptied completely before filling again. For GCC, it is not possible or feasible to turn the bunker more 1 time.

The gunite storage option has a positive NPV with 2.5 turns (250%), and a positive IRR at all levels. This option has the highest NPV at the 250% level at $1,031,749. Gunite does not increase operational efficiency for the cooperative as no new equipment is installed. It will only increase the life of an existing concrete structure.

The green field concrete site results are reported in two different methods before and after tax savings. The reason for reporting with two methods is so GCC can gain an understanding of the economic performance under cooperative ownership or the entity that currently owns the green field elevator. The entity that owns the green field site has non-member business, thus, it can use depreciation as a tax savings. This gives insight into the importance of tax savings for the investments performance.

The green field concrete storage option has a much higher initial cost associated with it at $7.15 per bushel of storage to construct. The IRR is negative at 1.5 turns (150%) before tax savings and is not reported. After tax savings IRR is a positive 3.45% at 1.5 turns (150%) which is higher than both concrete and steel. The after tax savings IRR at the

200% level is also higher than concrete or steel. The IRR being higher is caused by the tax savings from depreciation.

"What if analysis" was conducted to determine grain storage turns and margin would have to be to achieve NPV of 0 (Table 5.2). The first was to determine the break even percent of capacity use. Green field concrete needed the highest number of turns at 3.95 (395%) before tax savings and 2.72 (272%) after tax savings. Bunker storage needed the lowest number of turns at 1.42 (142%).

The second variable that the analysis looked at was the gross margin. This was conducted on the three capacity use scenarios. At 150%, the lowest gross margin to achieve an NPV of 0 this was $0.2151 per bushel handled for the bunker. The green field concrete needed the highest gross margin at all receipts levels to achieve NPV of 0. At 150% the green field concrete takes $0.4332 before tax savings being the highest. At 200% steel and concrete both moved under $0.30 to $0.2590 and $0.2582 respectively. Green field concrete after tax savings also moved below$ 0.30 to $0.2654. At 250% receipt level gunite gross margin dropped to $0.1937 per bushel being the lowest of all the options. Over the last ten years all of the gross margins in table 5.2 have been realized, except for the green field concrete before tax saving at 150% use level ($0.4332). Margins depend on many factors such as grain price, crop size, availability of storage, and demand.

Table 5.2: Elevator Turns and Gross Margin Breakeven

NPV = 0	Concrete	Steel	Bunker	Gunite	Green Field Concrete Before Tax Savings	Green Field Concrete After Tax Savings
Elevator turn percentage	262%	262%	142%	205%	395%	272%
Gross margin at 150%	$0.3166	$0.3146	$0.2151	$0.2669	$0.4332	$0.3251
Gross margin at 200%	$0.2590	$0.2582	$0.2018	$0.2212	$0.3464	$0.2654
Gross margin at 250%	$0.2244	$0.2244	$0.1939	$0.1937	$0.2944	$0.2296

Limited irrigation and drought scenarios were analyzed for each option (Table 5.3). The limited irrigation scenario lowers the number of turns a storage option will reach to 1 (100%). This scenario assumes that there would be one significant harvest. In Southwest Kansas, that would be wheat. All NPVs are negative in this scenario. The bunker never experiences positive cash flows, and thus the IRR for the bunker is negative and not calculated. The IRR for concrete, steel, gunite, and green field concrete are all negative but positive cash flows are experienced in each model.

Drought scenarios were examined in the first 3 years of each options life, with the storage being used at 75% of capacity (Table 5.3). The options were analyzed three times in this manner; capacity at 75% for three years then are moved up to 150%, 200%, or 250% in the remaining 27 years. In the first scenario of drought for 3 years the capacity use at 150%, all NPVs are negative with the least negative being bunker storage at a -$128,309 and the most negative being the green field concrete before tax savings at -$6,093,331.

All storage options were dramatically effected by drought in the first three years. The IRR for each storage option except green field concrete before tax savings is positive with the drought model at 150% capacity. As receipts increase to 200% and 250% after the first three years, the results improve for each significantly. The bunker has a positive NPV in drought scenarios that increase to 200% of capacity after the three years drought of 75%.

In the scenario where capacity use increases to 250% after three year bunker and gunite are a positive NPV. Concrete, steel and green field concrete remain negative.

Fixed labor was also analyzed to examine the effects of an increase or decrease in cost. Increasing labor may be adding another employee, additional benefits, or salary. Decreasing labor could be decreasing employee numbers or an increased efficiency of new storage that results in less employed labor. Fixed labor was changed upwards on each option by 20% of the base cost, and then used the three base scenarios of grain receipts. Fixed labor was also changed downward on each option by 20% of base cost, and then used the three base scenarios of grain receipts.

When fixed labor was adjusted, the NPV results were significantly changed. Raising these costs caused the NPV on all options to turn negative at 150% capacity use. This is significant because the bunker had been positive in the base model (Table 5.4). At 200% capacity use, the bunker became positive but less than that of the base model. Green field concrete before tax savings IRR remained negative at150% capacity use while all others were positive. Fixed labor being changed 20% percent downward had the opposite effect on investment. The major change was concrete and steel storage approached an NPV of 0 at 250% capacity use.

Table 5.3: Limited Irrigation Capacity Use 100% and Drought Scenarios Capacity use 75% in first 3 Years

	Concrete	Steel	Bunker	Gunite	Green Field Concrete Before Tax Savings	Green Field Concrete After Tax Savings
Elevator turns go to 100% (Limited Irrigation)						
NPV	($3,094,646)	($3,581,724)	($402,320)	($2,401,852)	($6,947,881)	($4,050,140)
IRR	N/A	N/A	N/A	N/A	N/A	N/A
The first 3 years of investment are drought 3 years at 75% then remaining at 150%						
NPV	($2,840,291)	($2,777,985)	($128,309)	($1,572,650)	($6,093,331)	($3,195,590)
IRR	2.43%	2.18%	7.89%	5.03%	N/A	3.27%
The first 3 years of investment are drought 3 years at 75% then remaining at 200%						
NPV	($1,918,780)	($1,874,661)	$213,706	($637,544)	($5,131,011)	($2,233,270)
IRR	5.98%	5.87%	15.66%	9.01%	2.02%	6.36%
The first 3 years of investment are drought 3 Years at 75% then remaining years at 250%						
NPV	($997,269)	($971,338)	$555,721	$297,562	($4,168,691)	($1,270,950)
IRR	8.72%	8.68%	21.34%	12.13%	4.35%	8.70%

N/A IRR cannot be calculated

Table 5.4: NPV and IRR Results with 20% Change in Fixed Labor

	Concrete	Steel	Bunker	Gunite	Green Field Concrete Before Tax Savings	Green Field Concrete After Tax Savings
Fixed labor increased by 20% of base labor receipts at 150%						
NPV	($2,785,750)	($2,734,293)	($51,827)	($1,509,999)	($6,036,375)	($3,138,634)
IRR	1.39%	1.00%	9.26%	4.27%	N/A	2.44%
Fixed labor increased by 20% of base labor receipts at 200%						
NPV	($1,657,838)	($1,631,801)	$426,196	($363,086)	($4,858,513)	($1,960,773)
IRR	5.88%	5.69%	25.81%	9.66%	1.36%	6.33%
Fixed labor increased by 20% of base labor receipts at 250%						
NPV	($529,927)	($529,310)	$904,219	$783,827	($3,680,652)	($782,911)
IRR	9.58%	9.50%	41.71%	14.39%	4.20%	9.39%
Fixed labor decrease by 20% of base labor receipts at 150%						
NPV	($2,274,775)	($2,223,317)	$203,233	($999,024)	($5,502,771)	($2,605,030)
IRR	3.57%	3.35%	18.31%	6.81%	N/A	4.36%
Fixed labor decrease by 20% of base labor receipts at 200%						
NPV	($1,146,863)	($1,120,826)	$681,256	$147,889	($4,324,909)	($1,427,169)
IRR	7.61%	7.52%	34.30%	11.81%	2.72%	7.78%
Fixed labor decrease by 20% of base labor receipts at 250%						
NPV	($18,951)	($18,334)	$1,159,279	$1,294,802	($3,147,048)	($249,307)
IRR	11.14%	11.14%	50.18%	16.41%	5.34%	10.64%

N/A IRR cannot be calculated

The results from each scenario in the base model and the sensitivity analysis helps provide a greater understanding of grain storage and the effects grain volume, margin, and cost on the economic profitability of each storage option. The results need to be used as a guide in decision making but cannot be solely used because of the high variability in initial cost. Operational needs of a storage option may not be available in each circumstance. Services required by the member owners may also be different than that of the highest NPV. The results emphasize the large volume of grain necessary to make grain storage economically profitable. Only bunkers are economically profitable under 200% capacity use with the assumptions used.

Further analysis and research should consider solutions to allow depreciation to be utilized on all projects. The reason is because recognizing depreciation of grain storage investments is an important component of the NPV analysis. If depreciation is accounted for on all projects the tax savings could boost the NPV and IRR for all projects considered, which would benefit cooperative members. Proof of this is found in examining the green field concrete before and after tax savings NPV and IRR. In this case, recognizing depreciation positively impacted the after tax NPV and IRR results.

The 10 year PV results of existing grain storage further illustrate the effect grain volume as a percentage of storage has on a grain storage investment. Table 5.5 includes the results of each elevator GCC operates. This may assist GCC in making informed investments. If current grain storage has a negative PV, it would not be ideal to update or expand that facility. If grain storage options have a positive PV over the next 10 years it may give GCC an idea of what they may be willing to invest in a particular location assuming no additional grain receipts will come from an investment.

Elevators in Table 5.5 may be losing wealth due to assumptions made. Elevator E and D for example most likely will receive a higher margin for grain than the model realizes due to the ability to store grain until market conditions are ideal. Elevator B is a facility that is seasonal and no fulltime labor is employed, thus an overstated labor cost is assumed in the model. Transferred grain is not accounted for, only the receipts from producers, which reduces the income from facilities where grain is transferred too and overstates facilities that grain is transferred from.

Table 5.5: GCC Current Locations 10 Year PV

Location	10 Year Average Percent of Storage Turned	10 Year PV
A	31%	($156,266)
B	40%	($493,027)
C	59%	($277,363)
D	68%	($57,301)
E	68%	($41,477)
F	75%	$79,197
G	78%	$202,971
H	94%	$652,862
I	96%	$790,283
J	101%	$716,642
K	104%	$915,841
L	130%	$678,029
M	140%	$1,396,910
N	157%	$1,156,078
O	164%	$1,094,614
P	184%	$2,394,514
Q	202%	$1,398,694
R	299%	$537,634

CHAPTER VI: CONCLUSIONS

Garden City Co-op continues to put emphasis on building grain storage that meets the operational needs and the needs of the member owners. When investing in grain storage one aspect to look at is the Net Present Value and Internal Rate of Return as was done in this analysis. Operations are also part of the equation and the criteria for the investment changes for every situation. Concrete grain storage that GCC owns will not last forever and there is a higher risk of storage failure as elevators age. NPV and IRR are effective tools used in this project to gain a greater understanding of grain storage economics. This analysis is intended to assist GCC in making decisions regarding replacing grain storage assets. Determining when to replace is much more a matter of structural engineering because current grain storage will most likely have a higher PV than the NPV of new grain storage, unless updating adds capacity and throughput.

Comparative analysis of each option under different circumstances highlights the effects assumptions have on the results. From the analysis, in most cases a bunker will yield a positive NPV at 1.42 turns (142%). It has also been determined that gunite will yield a positive NPV in cases where grain is turned more than 2.05 times (205%). Both bunkers and gunite provide no improvements to members in terms of speed and efficiency. This is a tradeoff that is made if bunkers or gunite are chosen as grain storage options.

Gunite may not be avoidable at times due to operational needs of an existing elevator. If a load out bin or a wet bin for a dryer, NPV and IRR may be no longer effective tools. The present value (PV) of the existing elevator should be used to determine the remaining economic profits of the elevator. If the PV of the existing elevator is positive then the option may be to repair a bins structural integrity with gunite. Other storage options would provide little value if the bin in question is of significant importance to the operation. If the PV of a facility is negative, the best action to take may be to not repair the bin in question. This option could have negative effects on operational efficiency of the elevator.

Bunkers are very inefficient operationally speaking and if they will not be turned more than 1.42 times a year (142%) they are not a good investment for GCC. At 100% of capacity bunkers are estimated to provide not only a negative NPV but a negative cash flow. GCC may not be able to turn a bunker more than 1 time a year. Most cooperatives use bunkers as the solution to the aging grain storage issue at hand. Few realize that turning a bunker 1 time a year is a bad investment for its member owner's. One way to obtain positive cash flows from bunkers at the country elevator would be to seek ways to reduce the variable labor cost.

Concrete storage is a viable option. Concrete provides a long term and efficient solution. The tradeoff is a lower NPV. Steel is also a viable option for storage. Steel lacks in terms of operations to concrete but the speed and efficiency to member owners is identical to concrete. Steel has a similar NPV and a lower IRR compared to concrete. If GCC were to choose steel over concrete due to the lower initial cost one tradeoff, would be the chance of concrete surpassing a 30 year life with low maintenance cost is high. From the analysis done in this project, the tradeoff for slightly lower initial cost of steel would not be worth forgoing concrete. Concrete generates larger annual cash flows than steel and has a higher IRR. Concrete will outlast steel and carry a much lower maintenance cost over an extended period. It is the belief of many cooperatives that steel is a good investment merely by looking at the initial cost. A green field concrete storage option has the lowest

NPV of all the options. The high initial cost severely hampers the economic profitability of the green field concrete and reduces the rate of return on the asset.

A green field site would need to be turned more than 2.72 (272%) times a year after tax savings to achieve a positive NPV. GCC is taking that tradeoff for new customers and member owner's demands to build a new elevator in a high production area. The speed and efficiency will be unmatched in the new elevator compared to most of Southwest Kansas, thus providing an efficient operation and superior service to the member owners. While the NPV of this facility may be negative, the overall PV of GCC total grain storage may increase due to additional bushels. The IRR of this project is also positive in the base model at all levels after tax savings. IRR shows that a return suitable for the members of GCC can be obtained at high volume levels.

Drought and limited irrigation are scenarios that have a probability of occurring over the long term in Southwest Kansas. The analysis indicates that these variables are estimated to have negative effects on any grain storage economic profits. The initial cost and grain receipts have the largest impact on the NPV for each of these projects. Annual cash flows from each option are similar. Three years of a large crop would have the exact opposite effect on results as three years of drought, thus making the projects NPV higher. Increasing or decreasing the fixed labor portion of any of the projects impacts the overall profitability.

6.1 Recommendations

GCCs first choice should be to invest in projects that will have a positive NPV. Choosing projects that have positive NPVs will insure member owners are receiving economic profits that enhance the benefits they receive from GCC. Since cooperatives are to maximize total members benefits GCC may have to invest in projects that have a negative NPV. Therefore, the second choice would be to invest in projects with the highest IRR.

There is a necessity for each circumstance to be considered individually. There is not one clear solution that will work for each situation. Economic analysis is only one part of the equation. Structural engineering, services required, and operational feasibility are also part of the equation. GCC should review each future project using economic analysis coupled with considering the other factors necessary to continue a competitive advantage in country grain handling operations.

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APPENDIX A- CONCRETE MODEL

Concrete Expansion Model	
Initial Cost	**Per Bushel**
Concrete	$2.10
Equipment	$1.76
Electrical	$0.30
Temp and Aeration Controls	$0.07
Ground Analysis and Work	$0.04
MISC.	$0.02
Total	**$4.29**

Variables	
Grain Price	$6.00
Size of New Storage	1,000,000
Total Initial Cost	$4,290,000
Receipts of Storage Capacity	150%
Through put (Handled)	2
Life of Investment	30
Opportunity Cost of Capital	11.20%
Average Gross Margin	$0.2180
Personnel Cost	
Fixed Per Bu of Storage	$0.1493
Variable Per Bu of Handled	$0.0187
Fixed	**Per Bushel of Storage Capacity**
Property Tax	$0.0198
License and permits	$0.0017
Insurance Building Per $1000	$1.7600
Insurance Grain Equipment Per $1000	$8.6900
Insurance Stock Per $1000	$0.7400
Operating	**Per Bushel Handled**
Utilities	$0.0174
Repairs and Maintenance	$0.0041
Plant Supplies	$0.0015
Safety and Compliance	$0.0011
Other	$0.0187
Shrink % Receipts	0.75%

Year	**0**	**1**	**30**
Bushels Handled a Year		3000000	3000000
Gross Margin		$654,000	$654,000
Personnel			
Fixed		($149,300)	($149,300)
Variable		($56,100)	($56,100)
Fixed			
Property Tax		($19,800)	($19,800)
Insurance		($25,650)	($25,650)
License and Permits		($1,700)	($1,700)
Operating			
Utilities		($52,200)	($52,200)
Repairs and Maintenance		($12,300)	($12,300)
Plant Supplies		($4,500)	($4,500)
Safety		($3,300)	($3,300)
Other		($56,100)	($56,100)
Grain Shrink Cost		($67,500)	($67,500)
Cash Flow		$205,550	$205,550
Initial Investment	($4,290,000)		
Net Cash Flow	($4,290,000)	$205,550	$205,550

NPV	**($2,530,690)**
IRR	**2.52%**

APPENDIX B- STEEL MODEL

Steel Expansion Model	
Initial Cost	**Per Bushel**
Steel	$1.90
Equipment	$1.76
Electrical	$0.30
Temp and Aeration Controls	$0.07
Ground Analysis and Work	$0.04
MISC.	$0.02
Total	**$4.09**

Variables	
Grain Price	$6.00
Size of New Storage	1,000,000
Total Initial Cost	$4,090,000
Receipts of Storage Capacity	150%
Through put (Handled)	2
Life of Investment	30
Opportunity Cost of Capital	11.20%
Average Gross Margin	$0.2180
Personnel Cost	
Fixed Per Bu of Storage	$0.1493
Variable Per Bu of Handled	$0.0187
Fixed	**Per Bushel of Storage Capacity**
Property Tax	$0.0198
License and permits	$0.0017
Insurance Building Per $1000	$6.3900
Insurance Grain Equipment Per $1000	$8.6900
Insurance Stock Per $1000	$1.7300
Operating	**Per Bushel Handled**
Utilities	$0.0174
Repairs and Maintenance	$0.0041
Plant Supplies	$0.0015
Safety and Compliance	$0.0011
Other	$0.0187
Shrink % of Bushels Receipts	0.75%

Year	0	1	30
Bushels Handled a Year		3000000	3000000
Gross Margin		$654,000	$654,000
Personnel			
Fixed		($149,300)	($149,300)
Variable		($56,100)	($56,100)
Fixed			
Property Tax		($19,800)	($19,800)
Insurance		($43,005)	($43,005)
License and Permits		($1,700)	($1,700)
Operating			
Utilities		($52,200)	($52,200)
Repairs and Maintenance		($12,300)	($12,300)
Plant Supplies		($4,500)	($4,500)
Safety		($3,300)	($3,300)
Other		($56,100)	($56,100)
Grain Shrink Cost		($67,500)	($67,500)
Cash Flow		$188,195	$188,195
Initial Investment	($4,090,000)		
Net Cash Flow	($4,090,000)	$188,195	$188,195

NPV	**($2,479,233)**
IRR	**2.22%**

APPENDIX C- BUNKER MODEL

Bunker Model	
Initial Cost	**Per Bushel**
Bunker Storage	$0.35
MISC.	$0.0018
Total	**$0.35**
Variables	
Grain Price	$6.00
Size of New Storage	1,000,000
Total Initial Cost	$351,800
Receipts of Storage Capacity	1.50
Through put (Handled)	2
Life of Investment	30
Opportunity Cost of Capital	11.20%
Average Gross Margin	$0.2180
Personnel Cost	
Fixed Per Bu of Storage	$0.0747
Variable Per Bu of Handled	$0.0787
Fixed	**Per Bushel of Storage Capacity**
Property Tax	$0.0198
License and permits	$0.0017
Insurance Building Per $1000	$4.2500
Tarp Yearly Cost	$0.0200
Insurance Stock Per $1000	$1.0500
Operating	**Per Bushel Handled**
Utilities	$0.0174
Repairs and Maintenance	$0.0041
Plant Supplies	$0.0015
Safety and Compliance	$0.0011
Other	$0.0187
Shrink % of Bushels Receipts	1.25%

Year	0	1	30
Bushels Handled a Year		3000000	3000000
Gross Margin		$654,000	$654,000
Personnel			
Fixed		($74,700)	($74,700)
Variable		($236,100)	($236,100)
Fixed			
Property Tax		($19,800)	($19,800)
Insurance		($10,853)	($10,853)
License and Permits		($1,700)	($1,700)
Tarp		($20,000)	($20,000)
Operating			
Utilities		($52,200)	($52,200)
Repairs and Maintenance		($12,300)	($12,300)
Plant Supplies		($4,500)	($4,500)
Safety		($3,300)	($3,300)
Other		($56,100)	($56,100)
Grain Shrink Cost		($112,500)	($112,500)
Cash Flow		$49,948	$49,948
Initial Investment	($351,800)		
Net Cash Flow	($351,800)	$49,948	$49,948

NPV	**$75,703**
IRR	**13.91%**

APPENDIX D- GUNITE MODEL

Gunite Model	
Initial Cost	**Per Bushel**
Gunite	$3.07
MISC.	$0.02
Total	**$3.09**
Variables	
Grain Price	$6.00
Size of New Storage	1,000,000
Total Initial Cost	$3,090,000
Receipts of Storage Capacity	1.5
Through put (Handled)	2
Life of Investment	30
Opportunity Cost of Capital	11.20%
Average Gross Margin	$0.2180
Personnel Cost	
Fixed Per Bu of Storage	$0.1493
Variable Per Bu of Handled	$0.0187
Fixed	**Per Bushel of Storage Capacity**
Property Tax	$0.0198
License and permits	$0.0017
Insurance	$0.0168
Operating	**Per Bushel Handled**
Utilities	$0.0174
Repairs and Maintenance	$0.0041
Plant Supplies	$0.0015
Safety and Compliance	$0.0011
Other	$0.0187
Shrink % of Bushels Receipts	0.75%

Year	0	1	30
Bushels Handled a Year		3000000	3000000
Gross Margin		$654,000	$654,000
Personnel			
Fixed		($149,300)	($149,300)
Variable		($56,100)	($56,100)
Fixed			
Property Tax		($19,800)	($19,800)
Insurance		($16,800)	($16,800)
License and Permits		($1,700)	($1,700)
Operating			
Utilities		($52,200)	($52,200)
Repairs and Maintenance		($12,300)	($12,300)
Plant Supplies		($4,500)	($4,500)
Safety		($3,300)	($3,300)
Other		($56,100)	($56,100)
Grain Shrink Cost		($67,500)	($67,500)
Cash Flow		$214,400	$214,400
Initial Investment	($3,090,000)		
Net Cash Flow	($3,090,000)	$214,400	$214,400

NPV	**($1,254,939)**
IRR	**5.58%**

APPENDIX E- GREEN FIELD CONCRETE

Green Field Model

Initial Cost	**Per Bushel**
Concrete	$2.05
Equipment	$3.54
Electrical	$0.51
Temp and Aeration Controls	$0.06
Ground Analysis and Work	$0.09
Scales and Probe	$0.34
Utilities and Water	$0.52
MISC.	$0.04
Total	**$7.15**

Variables	
Shrink Price	$6.00
Size of New Storage	1,044,285
Total Initial Cost	$7,469,771
Receipts of Storage Capacity	150%
Through put (Handled)	2
Depreciation Yrs.	7
Life of Investment	30
Opportunity Cost of Capital	11.20%
Average Gross Margin	$0.2180
Tax Rate	42%

Personnel Cost	
Fixed Per Bu of Storage	$0.1493
Variable Per Bu of Handled	$0.0187

Fixed	**Per Bushel of Storage Capacity**
Property Tax	$0.0198
License and permits	$0.0017
Insurance Building Per $1000	$1.7600
Insurance Grain Equipment Per $1000	$8.6900
Insurance Stock Per $1000	$0.7400

Operating	**Per Bushel Handled**
Utilities	$0.0174
Repairs and Maintenance	$0.0041
Plant Supplies	$0.0015
Safety and Compliance	$0.0011
Other	$0.0187
Shrink % of Bushels Receipts	0.75%

Year	0	1	30
Bushels Handled a Year		3132855	3132855
Gross Margin		$682,962	$682,962
Personnel			
Fixed		($155,912)	($155,912)
Variable		($58,584)	($58,584)
Fixed			
Depreciation - Tax Savings		$618,924	$0
Property Tax		($20,677)	($20,677)
Insurance		($42,848)	($42,848)
License and Permits		($1,775)	($1,775)
Operating			
Utilities		($54,512)	($54,512)
Repairs and Maintenance		($12,845)	($12,845)
Plant Supplies		($4,699)	($4,699)
Safety		($3,446)	($3,446)
Other		($58,584)	($58,584)
Grain Shrink Cost		($70,489)	($70,489)
Cash Flow		$817,515	$198,591
Initial Investment	($7,469,771)		
Net Cash Flow Before Tax Savings	($7,469,771)	$198,591	$198,591
Net Cash Flow After Tax Savings	($7,469,771)	$817,515	$198,591

Before Tax Savings	
NPV	**($5,770,020)**
IRR	**N/A**
After Tax Savings	
NPV	**($2,872,279)**
IRR	**3.45%**

APPENDIX F- CURRENT ELEVATORS PV MODEL

Current GCC Elevator	
Shrink Price	$6.00
Size of Storage	………..
Receipts of Storage Capacity (10 Year Average)	1.40
Through put (Handled)	2
Life of Investment	10
Opportunity Cost of Capital	11.20%
Average Gross Margin	0.2180
Personnel Cost	
Fixed Per Bu of Storage	0.1493
Variable Per Bu of Handled	0.0187
Fixed	**Per Bushel of Storage Capacity**
Property Tax	0.0198
License and permits	0.0017
Insurance	0.0168
Operating	**Per Bushel Handled**
Utilities	0.0174
Repairs and Maintenance	0.0041
Plant Supplies	0.0015
Safety and Compliance	0.0011
Other	0.0187
Shrink % of Bushels Receipts	0.75%

Year	1	10
Bushels Handled a Year	3570000	3570000
Gross Margin	$778,260	$778,260
Personnel		
Fixed	($190,358)	($190,358)
Variable	($66,759)	($66,759)
Fixed		
Property Tax	($25,245)	($25,245)
Insurance	($21,420)	($21,420)
License and Permits	($2,168)	($2,168)
Operating		
Utilities	($62,118)	($62,118)
Repairs and Maintenance	($14,637)	($14,637)
Plant Supplies	($5,355)	($5,355)
Safety	($3,927)	($3,927)
Other	($66,759)	($66,759)
Grain Shrink Cost	($80,325)	($80,325)
Cash Flow	$239,190	$239,190
Net Cash Flow	$239,190	$239,190
PV	**$1,396,910**	