Investment Decisions of Logistical Infrastructure in Stafford County

by

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Abstract

Intermodal freight transportation is the second largest source of revenue for North American Railroads (Rickett 2013). Intermodal transportation is best defined as the "coordinated door to door delivery of freight using two or more modes of transportation". In the state of Kansas, the majority of intermodal facilities are located in large metropolitan areas, and services a wide variety of products. In rural communities, intermodal facilities are used mainly for the marketing of grain commodities such as wheat, corn, milo and soybeans. The primary objective of this study is to determine the feasibility of the potential investment of a grain intermodal loading facility (referred as shuttle loaders) in the rural community of Stafford County, located in South-central Kansas. A secondary objective will focus on identifying alternative uses for the intermodal facility. Stafford County is a rural community west of Wichita, Kansas with a population of 4284 inhabitants. The largest industry measured as share of employment is Agriculture & Forestry, which contributes 17.6% of total employment for the county (USDA Data, 2016). The motivation for this study is to foster the economic development of the county by attracting public and private investment that will allow for the creation of new jobs and the increase of the tax base of the region. Financial results show little evidence of sufficient grain density to support the investment of a shuttle loader in the proposed area of study.

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Chapter 1-Introduction

Intermodal freight transportation can be defined as the "coordinated door-to-door delivery of freight using two or more modes of transportation (Rickett 2013). According to Berwick (2000), benefits of adopting intermodal transportation by shippers include lower transportation costs, increased economic productivity, reduced congestion on highway infrastructure, reduced energy consumption, and higher returns from private and public investments.

In rural communities, intermodal shipping may contribute to the economic development of the region (through improvements in tax revenue, creation of jobs and transportation costs reductions) while providing an opportunity for local shippers to compete in the domestic and export markets. In order for an intermodal terminal to be successful in rural communities, there are some key components to consider. The location of the terminal should be relatively close to shippers to create an economic incentive to switch from truck to intermodal modes of transportation; in addition, a reflection of competitive service of time and price should be offered by the facility to entice shippers to go intermodal (Berwick 2000).

The combination of a grain shuttle loading facility and an intermodal transportation terminal provide an approach to manage the transportation, and storage of agricultural commodities and potentially value added products in rural Kansas. The efficiencies associated with shipping grain by shuttle trains have revolutionized grain transportation and created grain marketing opportunities for rural communities, agricultural cooperatives, grain companies and multinational firms since its inception in the 1970's. Shuttle loading facilities (hence forth referred to as shuttle loaders) essentially allow small to mid-sized industry participants to expand its marketing horizons beyond a local or regional scope. In addition, shuttle loaders enable grain export companies to establish strategic origination points in the Midwest to better serve world's import demand for grain. A study conducted by Kansas State's Department of Agricultural Economics concluded that during the 2010-2015 periods, rail tariffs delivered by shuttle trains were, on average, 23.3% lower than delivery using non-shuttle trains (Taylor 2017).

The period with the greatest expansion of shuttle loader facilities was during the 2000's, which coincided with the rapid growth of grain production seen in main production states (Kowalski 2013). Currently, the market seems to be saturated with shuttle facilities around main grain production states such as Iowa, Illinois, Montana, Kansas, Nebraska, and others. As a consequence, the cost of building these facilities has increased nearly four-fold since 1990 (Kowalski 2014). In addition, Kowalski argues that the return on investment has shrunk from 20 percent (during early 2000's) to the 5 to 10 percent range and in some cases, nearly close to breakeven points (post-expansion period).

In the state of Kansas, there have been substantial investments made on intermodal facilities due to the state economy's heavy dependence on agriculture. Currently, there are more than 300 shuttle loaders in Kansas which is 6 to 8 more loaders than the state of Montana, considered another major agricultural state (Taylor 2016). The South-Central region of the state is composed of approximately eight counties with at least one or two intermodal facilities per county. However, Stafford County is an exception. The county does not have a shuttle loading facility. The logical question here becomes, why has Stafford County not pursued this type of facility? To answer this question, this study examines the main business activities that will help determine if there is a need (if any) of this type of facility.

According to the Kansas Agriculture's Economic Impact Report of 2018 published by the KDA (Kansas Department of Agriculture), Agriculture, Food and Food Processing sectors support 942 jobs (direct and indirect) or 36.57% of the entire workforce in Stafford County. These sectors provide a total economic contribution of roughly $290.8 million to the county (KDA 2018). In addition, these sectors' contribution to the GRP (Gross Regional Product) is approximately 34.75% or approximately $68.1 million. This contribution explains that personal income, business income and taxes generated by these sectors account for 34.75% of the total economy of the county (KDA 2018).

The top two agricultural activities that contribute the most to total economic output for the county are grain farming (27.64%) and beef cattle ranching (24.8%). These activities are followed by "other animal food manufacturing" (15.7%), oilseed farming (12.3%) and flour milling (10.28%).

In the grain farming sector, the major crop produced in the county is corn with 145 million bushels produced over the last 9 years. Wheat follows, with a production of 107 million bushels in the same time period. Milo and soybeans make up the remaining volume of grain produced in the area, but the total volume of the two grains are less than corn production in the county. Although these production volumes may seem high, when compared to Stafford's surrounding counties (six in total), the county is not the most grain dense. Stafford County ranks 3rd and 5th out of six in production for corn and wheat respectively. Figure 7 and Figure 8 (See Appendix I) show production heat maps for wheat and corn from 2006 to 2018.

Corn, soybeans and milo are consumed primarily in the state of Kansas. The major buyers of this crop are ethanol mills and feedlots. Despite that corn is the predominant crop produced in the state, wheat is the most exported crop from the state (Taylor 2017). According to Taylor et, al, 2017, wheat rail shipments were 4 to 8 times larger than any other crop in the state during the 2003-2013 period of the study. Taylor shows that 97.8% of wheat shipments were exported out-of state. Her research suggests that demand dynamics for wheat are primarily driven by macroeconomic factors outside of the state of Kansas.

The primary destination of Kansas wheat shipments is the Gulf of Texas, which accounts for approximately 58% (or 41 million tons). A secondary market of Kansas wheat is the Pacific North-west, which ships product mainly from the international port located in Portland, Oregon. Other important export destinations of Kansas wheat are Illinois, southern Louisiana and Southern California (Taylor 2016). For the purposes of this study, the two main export destinations that will be analyzed will be the Gulf of Texas and the Pacific North-West. Compared to its 6 surrounding counties, Stafford ranks 5^{th} and 3^{rd} in wheat and corn production respectively.

An acknowledgment of the economic drivers mentioned previously elicits other important questions: Why has Stafford County, a region highly dependent on grain farming and flour milling, with relatively decent grain density, not invested in nor adopted an intermodal facility? What are the major limitations that could be preventing an investment of this type to be implemented in this region? What are the incentives needed to be present for an investment of this type to be economically viable? How can Stafford County leverage its resources and capabilities to attract private investment for its grain logistics infrastructure?

To answer this question, this study is going to focus on one overall objective, which is to analyze the potential investment of an intermodal loading facility in the rural community of Stafford County, located in South Central Kansas.

Research Problem

The combination of high concentration of shuttle loaders, low ROI and high capital costs associated with shuttle trains poses serious risks for future investment considerations on these types of facilities. Consequently, these risks presents challenges for rural counties (such as Stafford) interested in generating income from its resource endowments. In addition, the relationships between shipper, carrier and suppliers of grain (country elevators and producers) are evaluated with scrutiny to understand the economic incentives under which each participant operates. All of these factors are taken into consideration when determining an investment decision of this type. In the case of Stafford County, the study's research question is revised further to ask: What are the investment options to be considered for the implementation of an intermodal loading facility in Stafford County? Though an investment in a high-speed grain handling facility does not guarantee success, alternative or complementary agribusinesses might enhance the investment prospects for an intermodal loading facility. The objectives of this study are to: 1) identify the determinant factors necessary for public and private investments in intermodal facilities; 2) determine to what extent are these factors present in the area (comparatively); 3) analyze the level of significance of these factors among areas where current logistical terminals operate; 4) decide/determine/conclude whether or not investing in an intermodal facility for Stafford County is feasible; 5) identify alternative uses for the intermodal loading facility.

Research Contribution

This study contributes to the public and private academic literature concerning the investment in agriculture in rural areas. Specifically, it allows stakeholders to understand the economic and social conditions on which these rural areas function and how business activities related to agricultural grain trading could contribute (or detriment) to the economy of rural America. According to a CoBank analyst, there is a general consensus among grain industry experts that the concentration of shuttle loaders in the Mid-west is near saturation point. The analyst postulates that, “There are only 1 to 2 percent feasible locations remaining west of the Missouri River” (Kowalski 2014). This study aims to address this statement by analyzing the feasibility of the investment of a shuttle loader in the South-central region of Kansas. In other words, this study aims at determining if Stafford County belongs to the 1-2 percent feasible group or not. There are numerous companies that conducted private or “in-house” studies to determine the feasibility of shuttle loaders in rural counties, but these studies are almost never disclosed to the public. It is widely understood that rural areas in the U.S. are underperforming metropolitan areas, and that gap is widening. This study adds to the academic literature that examines the grain industry’s decision to invest in shuttle loading facilities in the state of Kansas after the expansion period of the 2000’s. The results derived from the study will aid industry participants (shippers, carriers and government entities) to understand the main considerations and implications regarding investments in shuttle train loading facilities.

Chapter 2-Literature Review

This chapter of the study is composed of two main subsections. The first section refers to the operational overview of intermodal transportation in the U.S. This section focuses mainly on the historic importance of intermodal transportation in the U.S, types of intermodal facilities, characteristics of grain shuttle loaders, types of grain transfers, design of grain shuttle loaders, railroad and elevator assets in Kansas, and finally, an overview of the future grain industry trend towards the use of grain shuttle loaders.

The second section discusses the various methods used by researchers to evaluate investments in capital intensive projects. These methods focus mainly on financial analysis and the economics of risk and uncertainty.

History of Intermodal Transportation

Historically, intermodal freight transportation has gained significant importance in the logistics' industry in the U.S over the past decades. According to Rickett (2013), it is the second largest source of revenue for North American railroads. As of 2017, the number of intermodal containers and trailers showed a 4% (roughly around 521,121 units) year-over year- growth compared to 2016.This volume surpassed that of the previous annual high observed in 2015.

The need to integrate separate modes of transportation to reduce transaction costs (overhead, delays, and demurrage) gave rise to intermodalism. Previous to the 1950's, transportation systems were segmented, un-integrated and operated in their own "silos" (Paul 2017). Every mode carrier considered their peer as a direct competitor and sought to increase profitability by maximizing the line-haul under their control (Paul 2017). In addition, the regulated environment under which railroads operated hindered any attempts of consolidation and integration of services offered by carriers.

As a result, intermodal activities became operational in the late 1950's pioneered by the Southern Pacific Railroad (Encyclopedia Britannica 2017). Intermodal facilities were mainly "piggybacking" of highway trailers on rail flatcars. By 1980, U.S railroads recorded more than two million piggyback car loadings a year (Encyclopedia Britannica 2017). During the 1980's and 1990's, a new modality of intermodal came into effect: containerized loads. This new form of intermodalism arised as a result of the substantial growth of global trade (Clarke 2010). During this same period, the Staggers Rail Act was put into effect by the Carter administration. This act effectively offset the regulatory scrutiny enforced by the interstate Commerce Commission (ICC) which had as main objectives of the control of freight rates, oversee of merger and acquisitions and regulation of competition between modes (Slack 2017). The regulatory environment under which the rail industry was operating prior to 1980 resulted in a substantial loss of market share against interstate highways and airlines. Between 1920 and 1975, the market share of railroads decreased from 75 to 35% (Slack 2017). Given this imminent collapse, the Staggers Act relaxed majority of the regulatory law regarding railway operations. The major regulatory changes of the Act were to 1) allow carriers to charge any given rate for services unless ICC determined there was no competition for such services; 2) remove industry wide rate adjustments; 3) allow rail carriers to establish contracts without prior approval by ICC; 4) allow access of private railroads in case of bottlenecks; and 5) dismantle the collective rate making infrastructure among railroads.

As a result of these policies, consumers have benefited from lower rates, and railroad productivity and volume have peaked to record levels. The alleviation of restrictions of intermodal ownership has led to a revitalization of the freight business, leading to alliances with trucking companies to provide long-haul freight services (Slack 2017).

Intermodal facilities are characterized by the types of, containers, grain transfer and storage and handling. Middendorf (1998) identifies the types of containers and how they are transported. Trailer on flat car (TOFC) and Container on flat car (COFC) are used to transport containers on interstate highways and transferred on motor carriers and railroads. Auto terminals are to transport finished vehicles such as automobiles, light trucks, jeeps are transferred between different modes of transportation. They are designed for either direct transfer or short-term transfers. Another method that is commonly used the Truck-Rail Bulk Transloading Facilities, which directly transfer of dry and liquid cargo between rail and highway vehicles. Middendorf includes Truck-Rail Reload Facility that uses warehouses, distribution centers and other locations where break-bulk commodities are transloaded between motor carrier and railroad. The cargo may be transloaded directly between modal vehicles using forklifts, cranes, or it may be placed in an open area for short-term storage.

Grain Transfer

Transfers are an important aspect of handling containers that requires unique transportation assets to pick and place containers from cargo ships directly to a carrier for storage or direct shipment. For example, direct transfer involves containers that are lifted off a ship (usually with container cranes) and placed directly on double stack railcars. Short-term storage transfer use inbound cargo that is stored for a relatively short period of time, on a platform or loading dock and subsequently loaded into and hauled away by the outgoing mode of transportation. Also, transfers are used for long-term storage. It involves inbound cargo that arrives with a cargo carrying capacity lower than the outgoing mode and incoming cargo is relatively higher capacity than the outgoing/departing mode. In the latter case, the cargo is unloaded into a warehouse, storage tank or silo, and gradually distributed within the locality or larger region.

Intermodal freight terminals are capable of handling various types of cargo and they are custom designed to ultimately serve the greatest demand potential of a specified group or set of cargos in an established geographical location. Broadly speaking, all cargo can be categorized in either containerized or non-containerized (MiddenDorf 1998). Non-containerized cargo is further subdivided into break-bulk, dry bulk and liquid bulk.

Break-bulk cargo refers to freight generally shipped in either packaged or unitized form. Examples of this are bags, barrels, boxes, cartons, pallets, and other forms of packaged goods. This category of cargo could also classify products that are not packaged for shipment such as machinery, equipment, vehicles, lumber, paper and others (MiddenDorf 1998). Dry bulk freight refers to cargo consisting of "loose granular or free-flowing dry cargo which is shipped in bulk" (MiddenDorf 1998). Examples of cargo transported as dry bulk freight are grains, fertilizers, animal feed, oilseeds, sand, gravel, coal, ores, cements, and others. Finally, liquid bulk cargo refers to liquified freight shipped in bulk rather than packaged or containerized form (MiddenDorf 1998). Most popular examples of this type of cargo include crude oil, fuel oil, gasoline, lubricants, industrial and agricultural chemicals, vegetable oils, animal fats, and others.

Containerized cargo consists of freight shipments of a wide array of products ranging from dry bulk commodities (such as agricultural commodities and coal) to refrigerated consumer goods, electronic equipment, clothing and other products. The only type of freight that could not be handled by containers would be large dimensional commodities such as construction equipment, turbines, steel beams and other oversized equipment (MiddenDorf 1998).

Grain Storage and Handling

Grain elevator facilities are devoted to the storage, handling and distribution of grain commodities (such as soybeans, wheat, corn, feeds, flour and other related products). These can be classified as either “country “or “terminal”. Terminal elevators are further categorized as inland or export types (EPA 2017). Generally, tasks of cleaning, drying and blending of commodities are also performed by these facilities.

Country elevators are generally smaller in size, and origination of grain is done by truck on a reduced geographical radius (15 to 30 miles). Country elevators were originally built to provide storage capacity to crop producers (located nearby) that did not have sufficient on farm storage to store their grain. As a result, these types of elevators do not turn their inventory very often (generally inventory turnover ranges from 1 to 2 per year).

Terminal elevators hold a storage capacity of no less than 2.5 million bushels and are mainly devoted for long-haul transportation nationally and to main export markets (EPA,KDHEKS 2017). These elevators are specifically designed to move large quantities of grain in very narrow time windows (less than 15 hours). Terminal elevators can turn their inventory up to 9 times per year (private source). It is important to recognize these distinct differences in business models to better understand what grain marketing strategies each elevator will tend favor or adopt the most.

Design of Grain Elevators

Figure 1 shows a simplified process flow diagram of major grain elevators. Grain can either be received through truck, rail or barge. The next step is to go through the conveyor and the receiving leg which loads the grain to be sent to dryer and cleaning vents. After the grain has been handled for quality purposes, it goes to a distribution channel which classifies grains by type, customer and quality attributes. Once grain is ready to ship, grain is transported to an intermediate storage bin which then unloads to truck, rail and barge to be ready for its next shipment.

Figure 1 Elevator Process Flow Diagram

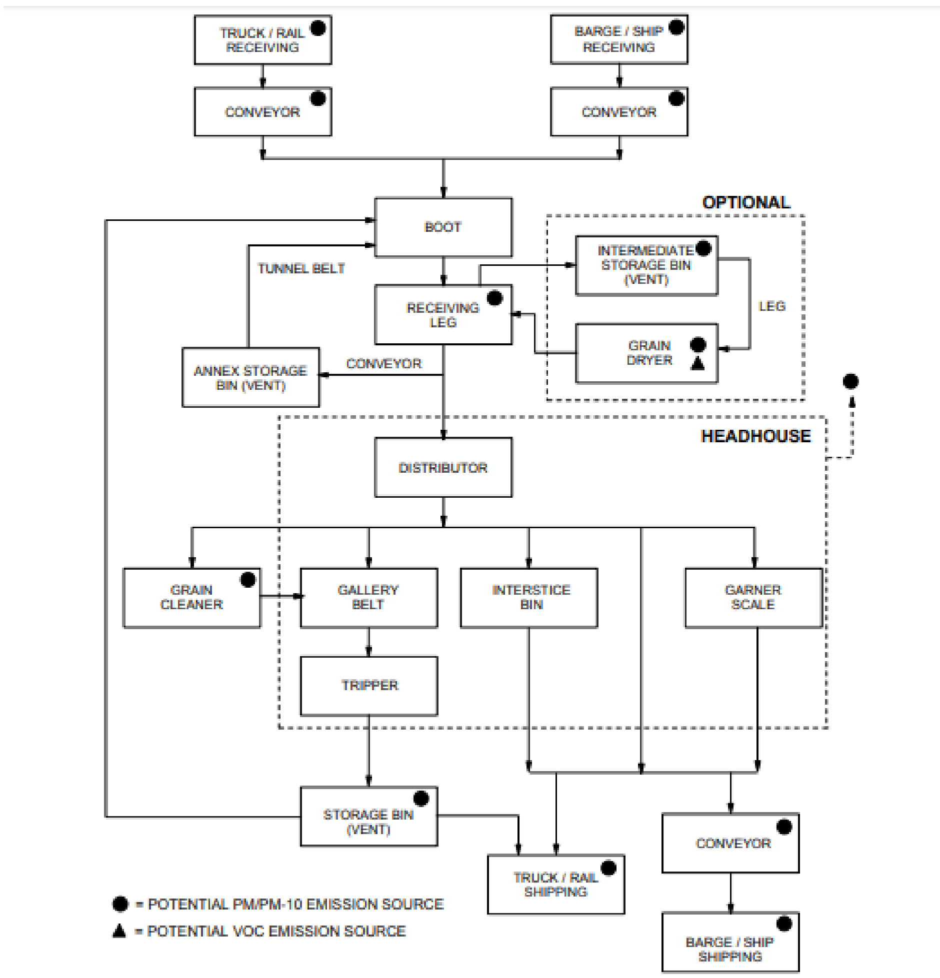
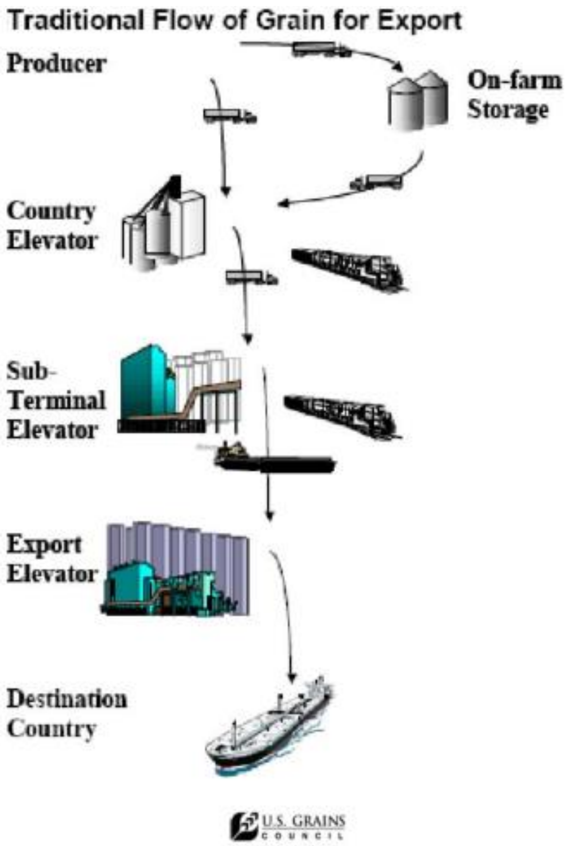


Figure 2 illustrates the traditional flow of grain. It begins with the farmer or producer and flows to its final node at the export elevator. Note the storage points and modes of transportation throughout the supply chain.

Figure 2 Grain Supply Chain



Types of Intermodal Terminals

There are two types of grain intermodal terminals. The first originates grain from various suppliers (mostly country elevators and farmers) in the area and subsequently stores them in concrete cylindrical towers (commonly referred as silos) for future rail (hoppers cars) or barge (vessel) shipments. The second one serves the purpose of purely transloading cargo from one mode to another. The term transloading refers to the process of physically transferring cargo from one mode's equipment to another without having to use some type of intermediate storage. This type of facility handles containerized cargo and is generally less common in the agricultural grain space.

Shuttle train Characteristics and Shipping Capacity

According to USDA-AMS, shuttle trains have three main characteristics

- The locomotives and crew are not detached from the grain cars, but remain with them throughout the movement
- The train service is contracted for a specified number of shipments over a 6 to 9 month period between specific origin-destination pairs, and,
- There are incentives for limiting loading and unloading time

Unit trains are bounded between 25 and 75 cars while shuttle trains are bounded to 75 cars and up (typically the upper bound ends at 120 cars).

One rail car holds approximately between 3500 and 3800 bushels (228,000 pounds) of grain. A traditional 110 shuttle train has the capacity to ship approximately 401,500 thousand bushels (roughly 24 million pounds).

Shuttle train facility requirements

Loading and unloading shuttle trains require sufficient trackage to allow 110 railcar trains and three locomotives to arrive and depart without decoupling any cars. Trackage can be on a linear siding parallel to the main line or a loop track. Linear siding requires roughly 50 to 100 acres of land (around 1.5 miles). A loop track takes at least 100 acres of land. The grain handling operation must be able to load and unload cargo under a 15 hour timeframe. This translates to a loading efficiency rate of 40,000 to 50,000 bushels per hour. Other important aspects of shipping and handling shuttle trains include: an ability to generate origin weights and grades, and a minimum of 440,000 bushels of upright storage in order to fill a BNSF railroad's shuttle train. BNSF has no interest in maintaining ownership of any shuttle-loading facilities. The shared investment remains up to private stakeholders such as grain companies, farmers or cooperatives. Generally speaking, BNSF prefers loop tracks versus linear line siding. Loop track design allows for a continuous loading of cargo while minimizing timely decoupling costs (KDT 2017).

Railroad Classification

Railroads are classified according to their annual operating revenue. A Class I railroad is characterized by an operating revenue exceeding 457.9 million dollars. Class II railroad, often referred as "regional railroad", have operating revenues between 36.6 and 457.9 million dollars. Finally, Class III railroads, often called "short line railroad" have operating revenues of 36.6 million dollars or less.

The first railroad in Kansas was launched in 1859 between Elwood and Wathena. It was a five mile long Marysville railroad which corresponded to the westward extension of the Hannibal and St. Joseph rail lines (KDOT 2017). The subsequent years showed an exponential increase of private railroads installed in the state mainly attributed to population growth (KDOT 2017). By 1880, more than 15 private railroads operated in the state such as St. Louis, Atchison, Topeka, Kansas, and Missouri railways. A large railroad consolidation process resulted 100 years later following the deregulation of the railroad system in 1980 (Stagger' Act). The main objective to the consolidation of railroads was to have reduced operating costs and to gain substantial market power in the industry. Currently, there are 4,216 miles covered by all railroad classifications in the state. There are three Class I railroads operating in the state of Kansas: (1) BNSF Railway, (2) Union Pacific Railroad and (3) Kansas City Southern Railway (KDOT 2017). In addition, the mainline railroads converted their smaller rail branches into independent Class III railroads. Presently, there are 11 short line and 3 terminal/switching railroads in the state (KDOT 2017). The strategic geographical location of the state provides full transportation access to every region of the country as well as Canada and Mexico. In addition, Class I railroads operated in the state provide access to international ports through the Pacific Northwest, West and the Gulf of Mexico (KDOT 2017). According to the Kansas Department of Transportation, Kansas is ranked 15th in the country in the following categories: total miles of rail, total rail tons carried, rail carloads carried and farm products originated in the state.

Grain Elevators in Kansas

The National Transportation Atlas Data through the Bureau of Transportation Statistics identified 77 intermodal facilities located in Kansas that provide a variety of intermodal interactions. Most of the intermodal facilities (84%) accommodate the Rail – Truck commodity transfers followed by modal transfers at ports (8%) and airports (4%) as shown in Table 1.

Table 1 Intermodal Facilities by Type

Intermodal Type	Number of Facilities	Percent of Total
Rail-Truck	65	84.40%
Port-Truck/Rail	6	7.80%
Air-Truck	3	3.90%
Truck-Truck	3	3.90%
Total	**77**	**100.00%**

The majority of the intermodal activity occurs in the metropolitan areas. The Kansas City area has 23 facilities while Wichita has eight of the intermodal facilities. Topeka (5) and Hutchinson (4) each also have smaller clusters of intermodal facilities. The remaining 37 intermodal facilities are dispersed throughout the state as shown in Table 2.

Table 2 Intermodal Facilities by Urban Area

Urban Area	Number of Facilities	Percent of Total
Kansas City	23	29.90%
Wichita	8	10.40%
Topeka	5	6.50%
Hutchinson	4	5.20%
Rest of State	37	48.00%
Total	**77**	**100.00%**

According to BNSF Railway, there are five transload facilities in Kansas: (1) Metro Park Warehouse Fairbanks is a transload facility serving products such as grocery, wine, paper and various metals (aluminum, copper, and zinc) with a railcar capacity of 1; (2) Harcros Chemicals handles bulk products in the Kansas City area such as agricultural oils, acids, solvents, proxide and other agricultural products and chemicals with a loading capacity of 55 rail cars; (3) United Warehouse Company(UWC) in Wichita offers transload services for products such as bricks, household appliances, lumber, paper, groceries and other with a holding capacity of 15 railcars and 2 rail tracks; (4) Garvey Public Warehouse also offers warehousing and transload services in the Wichita area with similar product lines as UWC. Some of their products include lumber, wallboard, plywood, roofing materials, and others; (5) Transportation Partners and Logistics located in Garden City offers warehousing storage for dimensional products such as wind energy components, machinery, pole and posts, and others. Finally, the Union Pacific Delivery Service Partner has four transload locations in the Kansas City metropolitan area. These facilities serve as a Third Party Logistics service provider (3PL) for clients with needs of sampling, freight consolidation, packaging, re-wrapping and truck brokerage services. In addition, commodities stored varies widely ranging from food products, metals, liquid bulk and hazmat liquids (KDOT 2017). The rail car capacity for this 3PL company ranges from 3 to 75 railcars among its 4 facility locations.

U.S Grain Industry Trend

The U.S Grain Industry is an important segment of the U.S economy which commercializes large volumes of raw agricultural commodities across domestic and export markets. This industry is characterized by operating as a high volume, low margin business. Consequently, high levels of operating efficiency along as well established grain marketing strategies should be present to create sustainable business environment overtime. As a result, the industry is shifting its grain marketing-transportation system towards short-term storage facilities with access to shuttle trains for high-speed long-haul transportation (KDR 2017). Facilities built for long-term storage can no longer remain competitive due to a number of factors. First, elevator owners must invest in a strong farmer-customer relationship to ensure supply of sufficient grain volume to operate the facility. This comes as a result of the consolidation process characterized in the modern agricultural industry: fewer farms with greater land and “in-house” storage capabilities. Secondly, the competition is also consolidating, creating a highly competitive environment (KDR 2017). Thirdly, terminal elevator facilities (commonly referred as unit loaders or shuttle train loaders) are highly capital intensive and can only be justified if large volume of grain is moved through the facility (KDR 2017). Finally, the railroad industry provides narrow time windows for large cargo shipments, which also motivates the industry to transition towards “high speed load out” systems (KDR 2017).

The second section of this chapter focuses on past research methodologies conducted for various investment projects and economic feasibility studies. This section focuses on financial analysis, capital budgeting, risk, uncertainty and competition.

Economic Risk and Uncertainty

There is a vast amount of literature on several different capital budgeting techniques to analyze the return on investment of a project. A high degree of controversy exists among experts in order to reach to a consensus on which method is considered the best or the most optimal. Nevertheless, there are two concepts that virtually all experts agree that should be considered when making an investment decision: risk and uncertainty. The situation of risk and uncertainty arises due to the fact that any firm in a particular industry has by definition imperfect knowledge concerning economic relationships and the future course of events (Olson 1968). Given the nature of imperfect information or knowledge, a firm must necessarily take into consideration risk when making short run or long run investment decisions (Olson 1968). "The concern with future consequences and future states of the world coupled with imperfect knowledge immediately introduces the element of decision under risk and uncertainty" (Shefer 1975). Shefer defines uncertainty as: "Uncertainty means that at the time of the decision, the decision maker cannot be absolutely sure as to precisely what every ramification of any action he takes will be". Given this definition, the general problem of decision making under uncertainty is how to choose between several possible acts when the consequences of the acts are not known with complete certainty (Shefer 1975). In addition, the term "decision" implies that the change of state in question is not the only possible state, and that there is at least one other possibility, thus, a decision involves choice of one course of action where there are other alternatives or possibilities (Shefer 1975).

There are three main techniques to identify risk: Historical Analysis, Scenario Analysis and Process Mapping (Mapemba 2018). Historical analysis relies on gathering sufficient time series data to estimate the likelihood of a particular event or set of events occurring and understanding the consequences or implications of making decisions under those risky events. Scenario analysis refers to a method in which the decision maker structures organized planning or investment decisions by generating an array of outcomes or options under which an organization or firm might be in the future. These scenarios allows for stress tests or relaxation of the status quo in order to understand the potential risks and develop risk mitigating strategies to reduce the probability of occurrence. Finally, process mapping refers to a management tool which uses visual representations of a process to understand the firm's internal functionality to optimize efficiency and the delivery of the organization's goals. For the purpose of this study, more weight will be put into the historical and scenario analysis techniques to identify risks.

Risk is classified in five main categories: value chain risk refers to risk related to quality, quantity, price, complexity, serviceability and timing; operation risk refers to risks related to systems, policies, procedures, processes and people; event risk refers to legal, regulatory, political, hazard, economic, and reputational risk; credit risk refers to liquidity, debt, vendor financing, and account receivable/payable related risks; finally, market risk refers to interest rate, commodity prices, equity prices and foreign exchange risks. This study falls into the categorization of value chain, market, credit and operational risks.

The five main risks associated with the investment of the intermodal facility located in Stafford County are:

1. Volume traded (market share)
2. Commodity Price Spread
3. Transportation cost (includes tariff rates, surcharges and railcar bids)
4. Competition
5. Capital Structure (Debt/Equity)

Table 17 (See Appendix) provides a full breakdown of associated risks related to the shuttle loader project.

There are four traditional approaches to help minimize risk and uncertainty in investment decisions: Lowering all gains or raising all costs in specific proportions, adding a "risk premium" to the interest rate used for discounting, shortening project lives, and reducing the final net gain figures in some proportion (Olson 1968). According to Olson, none of these traditional approaches are considered adequate to incorporate risk in the decision making process because they undermine the possibility of yielding a project with positive returns (or positive net present values). Alternatively, Olson's paper suggests incorporating two "modern" approaches to adequately incorporate risk in the decision making process: sensitivity analysis and the Bayesian decision theory approach. The sensitivity analysis approaches provides a range of net present value outcomes given a range on two or more variable costs. The idea is to provide the decision maker with a range of potential outcomes under which he/she should determine which outcomes would be more favorable and which could be less favorable to ultimately aid him/she to make the best possible decision. Nevertheless, the shortcoming of this approach is that it does not provide any basis on whether the project should be accepted or rejected. This leads to our second modern approach which is the Bayesian Decision Theory (BDT). BDT relies heavily on statistical decision theory which uses mathematical models as the basic tools for solving decision problems involving uncertainty (Shefer 1975). At is core, statistical decision theory makes use of probability theory and the modern theory of utility (Shefer 1975). Downside risk of agricultural portfolio of assets can be estimated through value-at-risk (Var) methodologies. Var determines the probability of a portfolio of assets losing a certain amount in a given period at a particular level of confidence (Manfredo 1999). According to researchers, applications of Var in the agricultural industry are suggested in the context of firm-level risk management. "Var could be beneficial in making hedging decisions, managing cash flows, setting position limits, and overall portfolio selection and allocation" (Manfredo 1999). Var analysis can also be used to determine the potential downside revenue from implementing (or not implementing) alternative pre-harvest marketing strategies for corn, wheat and soybeans. Var calculations are similar to forecasting the volatility of a portfolio over a particular time period. There are two estimation procedures for Var: parametric and full valuation procedures. Parametric procedures determine estimates of volatility and correlations under the assumption of normality while full valuation procedures model the entire empirical return or revenue distribution (Manfredo 1999).

Evaluating Competition and Internal/External Forces

In addition to evaluating the risks associated with the investment of a grain shuttle loader, it is necessary to assess the competitive environment under which the proposed facility might be subject to if decision is made to invest. To accurately assess the driving forces of competition and power, one must understand the market structure that characterizes the grain industry. There are several frameworks commonly accepted by academics and businesses executives to evaluate industry market structures and competition, this study is going to focus on two of them: HHI Index, and the Concentration Ratio. Furthermore, this study is going to rely on two additional supporting frameworks which will allow an understanding of internal and external forces that may either benefit or detriment the ecosystem under which the potential facility might be operating in. The two supporting frameworks are: Porter's Five Forces Model and SWOT Analysis.

The first two frameworks refer to market structure and competition. A market structure for any particular industry is composed of four categories or levels of competition: Perfect Competition, Monopolistic Competition, Oligopoly (Cournot and Bertrand) and Monopoly. Under perfect competition, the intensity of price and market share competition is fierce. A monopolistic market structure shows a lighter intensity of competition in comparison to perfect competition. In an oligopolistic structure, the competition might be either fierce (Bertrand) or light (Cournot), depending on the inter-firm rivalry. Finally, on a monopoly, the intensity of competition depends on the level or degree of product differentiation. Both the HHI Index and the Concentration Ratio make use of market share information to quantify the intensity of competition and they discriminate one level from another by introducing breaks for each market structure. For example, a HHI index of 6000 and above signifies a monopolistic structure while an index of 2000 or below signifies a perfectly competitive market. Furthermore, a concentration ratio of 50 percent or less may indicate a perfectly competitive market while a ratio of more than 60 percent indicates an oligopolistic structure.

Profitability Drivers of Shuttle Loaders

A shuttle loader maximizes profit by choosing a cash selling price "Ws", and subtracting all the marginal costs associated with handling the grain "Ms" (this includes storage, handling and transportation costs). The relationship with the competing conventional elevator (i.e degree of market power of elevator "X" with respect to other elevators in the area) will also play an important role in determining the profitability of the shuttle loader. Furthermore, in competitive grain commodity markets, agribusinesses are considered price takers, thus, the potential improvements in profit margins are limited to the ability of a firm on adopting efficient technologies and management strategies that will improve the cost of handling grain, and as a consequence, improve the bottom line of the company (Taylor 2017). As an example of improved cost efficiencies, the USDA-AMS report showed that wheat delivered by shuttle trains were on average 23.3% lower than deliveries using non-shuttle trains during the 2010-2015 periods (USDA, Agricultural Marketing Service 2016).

In addition, there are several key factors that will determine a positive (or negative) financial return on shuttle loaders. The main factors mentioned are future grain prices and basis levels, production volumes, railroad performance, ethanol policy and export demand particularly in Asia (Kowalski 2014).

In summary, the levels of local competition, financial risks and uncertainty, operational decisions are used to assess the economic viability of the grain shuttle loader project. In contrast to other academic papers that rely on one or two main conceptual models to derive results from, this project will rely on a number of frameworks extracted mainly from the business and finance literature to portray a simple, effective and comprehensive business analysis tool for decision making. It is important to note that there should be a consensus among frameworks employed on the final result or implications of the project. In other words, the competitive and financial models used should not yield contradictory results which can be misleading to the final decision maker.

Chapter 3-Methods

Four different methods are used when considering an intermodal facility. Results need to be consistent and should help the decision maker to elucidate his final view and ultimate decision about the investment project. For this study, an investment model is used to analyze the return on investment of a $16-20 million grain shuttle train facility (more often referred as a shuttle loader or an intermodal grain elevator) over a 5-15year period. This is considered a long term fixed asset investment on an elevator facility that will be equipped to store, load and unload hard red winter wheat and corn (initially, but will have the capabilities to handle other grains such as sorghum or soybeans) which is generally marketed out of state on main export terminals including the Texas Gulf, Pacific North-West and Oklahoma. This type of bulk commodity is generally transported (for long-hauls) on unit railcars of up to 120 cars.

The financial feasibility method will focus on determining the decision making outcomes that would maximize (or minimize) the net present value (NPV) of this particular investment project. The first step in conducting a net present value analysis is to generate a series of forecasted expected profit under three scenarios: base, optimistic and pessimistic. A portfolio analysis, followed by a parametric Var procedure, will be used to produce the forecasted profit margins under these three scenarios and evaluate the downside risk of the proposed portfolio. The conceptual model used is the following:

$$E(r)_i \;=\sum_{i=1}^{n}(p_x r_x)$$

Where $r_i$is the expected weighted return of asset (or stock) r_x having a probability of p_x. The proposed grain marketing portfolio will be composed by four “stocks” or asset classes which are distinctively different by the marketing periods on a given crop year (harvest, planting, post-planting and pre-harvest).

The risk or variance of the portfolio is given by:

$$\sigma \;= w_{X1}^{2}\sigma r_{X1} + w_{X2}^{2}\sigma r_{x2} + 2w_{x1}w_{x2}Cov(r_{x1}r_{x2})$$

Where $w_x$is defined as the weight of asset "x", σr_X is the variance of asset "x" and $Cov(r_{x1}r_{x2})$ is the covariance of two assets (this will vary depending on how many assets or stocks the portfolio has).

Adjusting for a four asset class portfolio, the expected overall portfolio and variance formulation are:

$$Er_g \;= p_A r_A + p_B r_B + p_C r_C + p_D r_D$$

$$\begin{aligned}\sigma_g \;= {} & w_A^2\sigma r_A + w_B^2\sigma r_B + w_C^2\sigma r_C + w_D^2\sigma r_D + 2w_A w_B Cov(r_A r_B) + 2w_A w_C Cov(r_A r_C) \\ & + 2w_A w_D Cov(r_A r_D) + 2w_B w_C Cov(r_B r_C) + 2w_A w_C Cov(r_A r_C) \\ & + 2w_B w_D Cov(r_B r_D) + 2w_C w_D Cov(r_C r_D)\end{aligned}$$

As a result of the forecast, an annual series of cash flows will be generated under these scenarios which in turn were used to calculate the net present value of the investment.

The NPV formulation is:

$$NPV \;= C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

Where the first term C_0 refers to the initial cash flow and the second term $\sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$ refers to the discounted cash flow (DCF) formulation. Specifically:

C_0 = Capital expenditure cost

C_t = net cash inflow-outflow for period t

r = discount rate or rate of return that could be earn in alternative investments

t = number of periods

A NPV of greater than 0 signifies the acceptance of the project and a NPV lower than 0 signifies rejection of the project.

To understand the downside risk of the agricultural portfolio, a parametric value-at-risk (Var) methodology has been used. The first step to calculate a parametric Var is to define the portfolio value. The portfolio value is:

$$PV \;\; = Er_g * EV_t$$

Where Er_g = Expected portfolio return (measured as dollar per bushel)

EV_t = Expected volume throughput in period t (measured in millions of bushels)

The second step is to determine the portfolio mean μ and portfolio standard deviation σ of "loss" assuming normality. The third step is to set a confidence interval level$c$, and, finally find the standard normal deviation (or z score) α corresponding to the confidence interval previously defined. The Var formulation then becomes:

$$VAR \;\; = Er_g - (\alpha * \; \sigma) * \; PV$$

In this study, the value at risk formulation measures the potential downside loss in gross profit margins under normal market conditions.

The competitive feasibility method of the study refers to an analysis of the competitive environment under which Stafford County operates. Two frameworks were used to determine the competitive feasibility on the project. The first framework is the Herfindahl-Hirschman Index (HHI) which evaluates the market concentration of shuttle loaders in Stafford County. The second framework is Porter's Five Forces Model, which evaluates the bargaining power of current participants in the market, degree of industry rivalry, and barriers to entry for new industry players. There are no established criteria to determine the feasibility given the results of these competitive frameworks. Nevertheless, each method helps to validate the results observed in financial feasibility portion of the analysis. The combination of the results from the financial and competitive feasibility helped to determine the final outcome of the project: feasible, feasible with changes or infeasible.

The final method refers to a qualitative method in which semi-structured interviews were conducted with grain industry participants to validate and align the assumptions, analyses and conclusions derived from the study's previously defined objectives. It was impractical to attempt to interview every company that owned shuttle loading assets in Kansas. It was decided to interview firms that were involved directly and indirectly in grain handling. This included railroads, large grain companies, farmer's cooperatives and a flour mill. The semi-structured interviews were selected as the means of validation of the data because of two primary considerations. First, they were well suited for the exploration of the perceptions and options of grain handling company regarding complex and sometimes sensitive issues and enable probing for more information and clarification of answers. Second, the varied professional, educational and personal histories of the sample group precluded the use of a standardized interview schedule. With this type of interview, validity and reliability depend, not upon the repeated use of the same words in each question, but upon conveying the same meaning. It is the same meaning which helps the semi structured interview and facilitates the validation of data.

Chapter 4-Data

Summary

Daily cash price data (2000 to 2018) for hard red winter wheat and corn was gathered from the United States Department of Agriculture' Agricultural Marketing Service division (USDA-AMS). These cash prices were based on a 30-day delivery period. Monthly tariff and surcharge fees data were compiled from the USDA' Transportation and Research Analysis division for the 2010-2018 period. Similarly, weekly railcar bids were compiled from the same source. Grain variable costs (storage and handling) and fixed costs (salaries, benefits maintenance, insurance, tax, and other expenses) were calculated with the support of private consultants with decades of experience in the grain industry. Grain shipments have been estimated based on USDA production data and previous research conducted by Kansas State faculty members specialized in the grain industry. Quarterly lending interest rates (farm real estate and farm machinery) have been gathered from the Federal Reserve Branch of Omaha, Nebraska for the last 20 years. Finally, shuttle loaders and country elevator locations and storage capacities were gathered from the Arthur Capper Cooperative Center interactive maps.

Rail Freight Rates

The three major components of total costs of railroad transportation costs are: tariff rates, fuel surcharges, and the secondary railcar market costs (Sparger 2013). Sparger argues that unlike barge, ocean or truck rates, tariff rail rates do not change on a weekly basis even if market pressures demand otherwise. Instead, railroads publish tariff rates which reflect market conditions based on historical data and future expectations. In the event these rates do not prevail (in most cases they do), rail companies are required by law to give 20 day notice before adjusting tariff rates (Sparger 2014). The rail cost component that accounts for the changes in supply and demand market dynamics (such as new information, expectations, macroeconomic conditions, and weather events) and captures market distortions, are the primary and secondary railcar auction markets, which affect the overall price of grain transported (Sparger 2013). “The primary source of value in obtaining guaranteed railcar placement lies in mitigating the risks associated with transport availability and cost” (Sparger 2013). The seasonality of agricultural shipments involves a risk to the shipper, and mitigating that risk involves a premium that adds to the overall cost of transport.

The Transportation and Research analysis division of the USDA reports monthly tariff rail rates and fuel surcharges for selected U.S origin and destination markets. These rates are considered “upper-bound rates”. In other words, these rates reflect the most a grain shipper would expect to pay for tariff and fuel surcharges on a given month or year. As one may expect, these rates may vary on a case by case basis depending on the level of relationship of carriers and shippers. Tariff fees are initially calculated on a dollar per shuttle car basis and later translated to a dollar per bushel fee. Fuel surcharge rates are initially calculated on a dollar per mile basis and later translated on a dollar per bushel basis as well. Finally, tariff and fuel surcharge rates are added and reported on a dollar per bushel basis for each origin-destination pair.

In addition to tariff rates and fuel surcharges, the carriers charge a fee for accessing shuttle trains at specific time periods. These fees are paid by shippers on the primary and secondary auction markets for railcars. These rates are reported on a weekly basis at the Grain Transportation Report provided by the Transportation division at USDA. Shuttle train bids are reported on a dollar per car basis. In order to translate the bid fee on a dollar per bushel basis, it was assumed that each rail-car holds roughly 3800 bushels. This way, the bid fee was also calculated on a dollar per bushel basis.

Freight rates paid by agribusiness companies are an integral cost component of grain shuttle loaders. To reiterate by Taylor, et al, the competitive advantage of shuttle loaders are derived from reduced rail rates that would come as a result of negotiations between elevator owners and rail companies whom will work to establish predetermined rates through short-term or long-term contracts. However, according to Kowalski 2014, railroads do not need grain businesses enough to force them to negotiate. In major grain producing states, such as Iowa, Illinois, and Nebraska for corn and Kansas, Montana and North Dakota for wheat, grain can account for half or more of railroad's origination. Nevertheless, for the U.S rail system nationwide, grain accounts merely for roughly 10 percent of total freight and revenue (Kowalski 2014). In 2010, grain represented 5.5 percent of all carloads originated, 8.2 percent of total tons and 8.4 percent of total revenue for Class I railroads (USDA-AMS 2014). Furthermore, Kowalski shows that in states where oil and gas production has soared, grain's rail' market share has decreased significantly. As a result of these factors, the bargaining power of agribusinesses against rail companies declined, thus, limiting the ability to elaborate beneficial contractual rebates on rail rates for grain shipments.

Grain Costs

Storage and Handling

The cost components of storing grain are:

- Storage
- Interest on grain inventory
- Extra drying of grain
- Grain shrinkage
- Handling cost, and
- Quality deterioration

Commercial storage fees vary among elevators, but usually there will be a fixed charge for the first few months with an additional charge for each additional month thereafter (Edwards 2018). Some elevators may charge a daily rate. Monthly storage fees are approximately valued at 3 to 4 cents per bushel (Key Cooperative 2018). The interest cost of having money tied up in storing grain represents the opportunity cost of generating income in the event that money was put to work elsewhere. Grain interest costs may vary from four to seven percent approximately. In the event grain is sold at harvest, interest expenses are reduced. Otherwise, if grain is stored, interest expenses will accrue and additional interest expense will be incurred by the commercial elevator. The cost of drying grain to a safe storage level is an integral part of the cost of storing grain. In the case of corn, farmers and elevators intend to maintain the moisture level to approximately 13 to 13.5 percent. The cost of drying comes from the fuel and power costs required to remove the additional moisture from the grain. Drying grain (or, in other words, removing the additional moisture of the product) reduces the number of bushels stored, which creates what is known by grain shrinkage (Edwards 2018). Generally, the loss due to shrinkage from moving grain in and out of storage is 0.5 to 1 percent (Edwards 2018). This represents a cost of storage that originates from the process of drying of the grain, thus, it must be included in the analysis. The in and out cost of loading and unloading in a commercial elevator is defined as grain handling cost. This cost varies based primarily on the amount of throughput or annual inventory turnover. In addition, the type of handling equipment, elevator leg efficiency, bin size and bin shape may also affect handling costs. The handling costs associated with most commercial elevator facilities ranges from $0.07 to 0.30 cents per bushel (Kenkel 2008). Table 3 shows the baseline assumptions on grain handling expenses.

Table 3 Grain Handling Costs

Baseline Assumptions for Grain Handling Costs	Rates
Elevator Capacity (bushels)	2,000,000
Purchase Price	11,000,000
Cost per bushel	5.5
Annual Maintenance Cost as % of Facility	1.00%
Leg HP/Bushel/hr	0.000625
Drag Conveyor HP/bushel/hour	0.0025
Dust System HP/Hour	15
% Shrinkage (in and out)	0.03%
Fumigation Cost per bushel	0.0025
Aeration Cost per bushel	0.00528
Electricity cost/Bu Turning	0.0008456

The costs of building a shuttle elevator (excluding land and track/switch costs) ranges from 11 to 15 million dollars for a 2 million bushel capacity facility. This range difference is due mainly to the type of building material (steel versus concrete). Thus, the baseline assumption in this study is an average of 11 million dollar purchase price based on steel bins.

The efficiency rate (capacity per hour) for a shuttle elevator leg ranges from 60,000 to 90,000 bushels per hour. The efficiency rate considered was 80,000 bushels per hour with a leg horsepower of 50. The aeration cost per bushel was calculated considering a 0.0003 horse power per bushel and 160 hours of fan time (cycle). Finally, the electricity cost per bushel was calculated considering an electricity cost per kilowatt of $0.11 and a total horsepower per bushel turning of $0.007. Table 4 illustrates the baseline grain handling expenses based on grain cash prices, shrink, moisture loss, fumigation, aeration and times turned per year.

Table 4 Grain Handling Costs by Commodity

Grain Handling Expenses	Corn	Wheat
Grain Cash Price $/bu	$ 4.35	$ 4.26
Shrink (in and out)	0.03%	0.03%
Moisture loss %	1.00%	0.50%
Fumigation cost/bu	$0.005	$0.005
Time Turned	3.63	3.63
Times Aerated	1	1
Times Fumigated	0.5	1.5
Moisture loss $/bu	$0.044	$0.021
Total shrink $/bu	$0.001	$0.001
Elevation costs $/bu	$0.001	$0.001
Turning cost per bu	$0.003	$0.003
Aeration cost per bu	$0.005	$0.012
Fumigation/bu	$0.003	$0.003
Total Variable Costs $/bu	**$0.056**	**$0.041**

As seen by Table 4, total grain handling expenses for both commodities are $0.097 per bushel. Corn handling costs are a penny higher due to greater expected moisture loss. Table 18 (Appendix) illustrates the summary of handling expenses for baseline, pessimistic and optimistic scenarios.

Fixed Costs

In addition to variable costs, there are fixed costs associated with operating grain elevators. The components of fixed costs used are salaries, benefits, maintenance, insurance, and property tax. Table 5 illustrates fixed costs associated with grain handling elevators.

Table 5 Grain Fixed Costs

Grain Elevator Fixed Costs	Rates
Salary	575,000
Benefit as % of salary	57,500
Maintenance % of facility cost	110,000
Insurance % of facility cost	165,000
Total Fixed Costs $	**907,500**
Total Fixed Costs $/bu	**0.12**

Majority of the fixed costs (70%) are related to salary and benefits. A total of eleven employees have been estimated to be necessary to run a shuttle elevator. There will be one merchandising manager, one operations manager, and one logistics supervisor. Furthermore, there will be five elevator operators, one administrative assistant and two accountants. Table 19 (Appendix) illustrates the expected salaries for each employee. In addition, Table 20 (Appendix) illustrates fixed costs at baseline, pessimistic, and optimistic scenarios.

Volume Throughput

In order to understand the opportunity (measured in millions of bushels) to serve the storage and shipment of hard red winter wheat and corn through the proposed facility, it was essential to know the grain shipments out of the county(more commonly referred to as elevator warehouse receipts). Given this information is not open to public and no governmental institution reports this information, this value had to be estimated through the following methodology. First, annual production data was gathered (in bushels) by county for the state of Kansas through the use of quick stat database provided by the USDA. Secondly, aggregate wheat shipments for the state of Kansas during the 2004-2013 period was extracted from Taylor's 2016 study on "Market Concentration in the Wheat Merchandizing Industry". Thirdly, an extraction percentage has been calculated by taking the proportion of wheat shipments to the total production in the state of Kansas. This extraction indicates the average percentage of wheat production that is actually shipped over the 2004-2013 period. During this period, roughly 23% of wheat produced in the state of Kansas is actually shipped out of state by rail. In the case of corn, the extraction percentage considered was 17%. This extraction indicator was applied to each county to get a proxy estimate of wheat and corn shipments by county. In addition, conservative market share gains were determined for each of the surrounding counties (total of 7) based on the following criteria: if the county had an aggregate grain storing capacity of 20 million bushels or more, market share gain would be 5 percent, otherwise, market share would be 15 percent. Table 6 and Table 7 show total estimated volume throughput for wheat and corn by county under the base scenario.

Table 6 Base Wheat Volume Throughput

County	Avg Annual Shipments*	Aggregate Capacity*	Market Share %	Shuttle Thru-Put*
Reno	5,880,465	27,667,000	5%	294,023
Ford	5,061,914	14,937,000	5%	253,096
Sedgwick	4,627,472	32,889,000	5%	231,374
Stafford	4,091,809	10,114,000	50%	2,045,904
Barton	3,968,180	12,176,000	5%	198,409
Pratt	3,883,638	8,362,000	15%	582,546
Pawnee	3,862,532	7,897,000	15%	579,380
Hodgeman	2,629,921	5,000,000	15%	394,488
TOTAL	**34,005,931**	**119,042,000**		**4,579,219**

*millions of bushels

Table 7 Base Corn Volume Throughput

County	Avg Annual Shipments*	Aggregate Capacity*	Market Share %	Shuttle Thru-Put*
Pratt	2,969,541	8,362,000	15%	445,431
Stafford	2,833,791	10,114,000	50%	1,416,896
Ford	1,601,477	14,937,000	15%	240,222
Reno	1,507,430	27,667,000	5%	75,372
Pawnee	1,487,037	7,897,000	15%	223,056
Sedgwick	1,361,911	32,889,000	5%	68,096
Barton	969,577	12,176,000	15%	145,437
Hodgeman	453,002	5,000,000	15%	67,950
TOTAL	**13,183,768**	**119,042,000**		**2,682,458**

* millions of bushels

As illustrated by the base scenario tables for wheat and corn, total volume throughput was estimated to be 7,261,678 million bushels. Furthermore, volume estimations for the optimistic and pessimistic scenarios were 7,954,237 and 6,569,118 bushels respectively, considering a 60 and 40 percent market share for Stafford County (See Appendix for Table 21 and Table 22). From the various interviews conducted for this study, the general consensus of industry participants was that in order to achieve breakeven levels, volume throughput ranges from 19 to 25 million bushels per year for a two to three million bushel facility. These volumes translate to roughly nine to twelve turns per year and four to five shipments per month. Table 8 illustrates a summary of volume throughput for each scenario as well as estimated turns per year and shipments per month (considering a shuttle 400,000 bushel shuttle train).

Table 8 Volume Throughput Summary

Variables	Pessimistic	Base	Optimistic
Corn	2,399,079	2,682,458	2,965,837
Wheat	4,170,039	4,579,219	4,988,400
Total Bushels	**6,569,118**	**7,261,678**	**7,954,237**
Turns per year	**3.28**	**3.63**	**3.98**
Shipments per month	**1.37**	**1.51**	**1.66**

By evaluating the values presented in Table 8, volume throughput is dangerously low and monthly shipments do not reach levels recommended by industry experts. The implications of these results will be further discussed in the financial analysis section of the study.

Cost of Capital

The cost of capital for the project is composed of the Capital Expenditure cost, most commonly referred to CAPEX. This CAPEX cost is subdivided into: the aggregate investment cost of the intermodal facility (which includes all building materials, unloading and loading equipment, rail switches, spurs, land, and all other cost associated to operate the facility) and the interest rate cost of acquiring capital for the project. The CAPEX is estimated at 16 to 20 million dollars. The full break out of the cost components are detailed on the financing section. The interest rate cost was extracted from the Agricultural Finance Databook provided by the Federal Reserve Bank of Omaha. According to senior economists at the Omaha branch, there are two reference rates that could be considered in this project: Farm machinery and equipment (15 year maturity) and farm real estate purchases (10 year maturity). To maintain the financial evaluation conservative, the farm machinery and equipment rates where used on this study.

Market Suppliers and Competitors

Shuttle Loaders

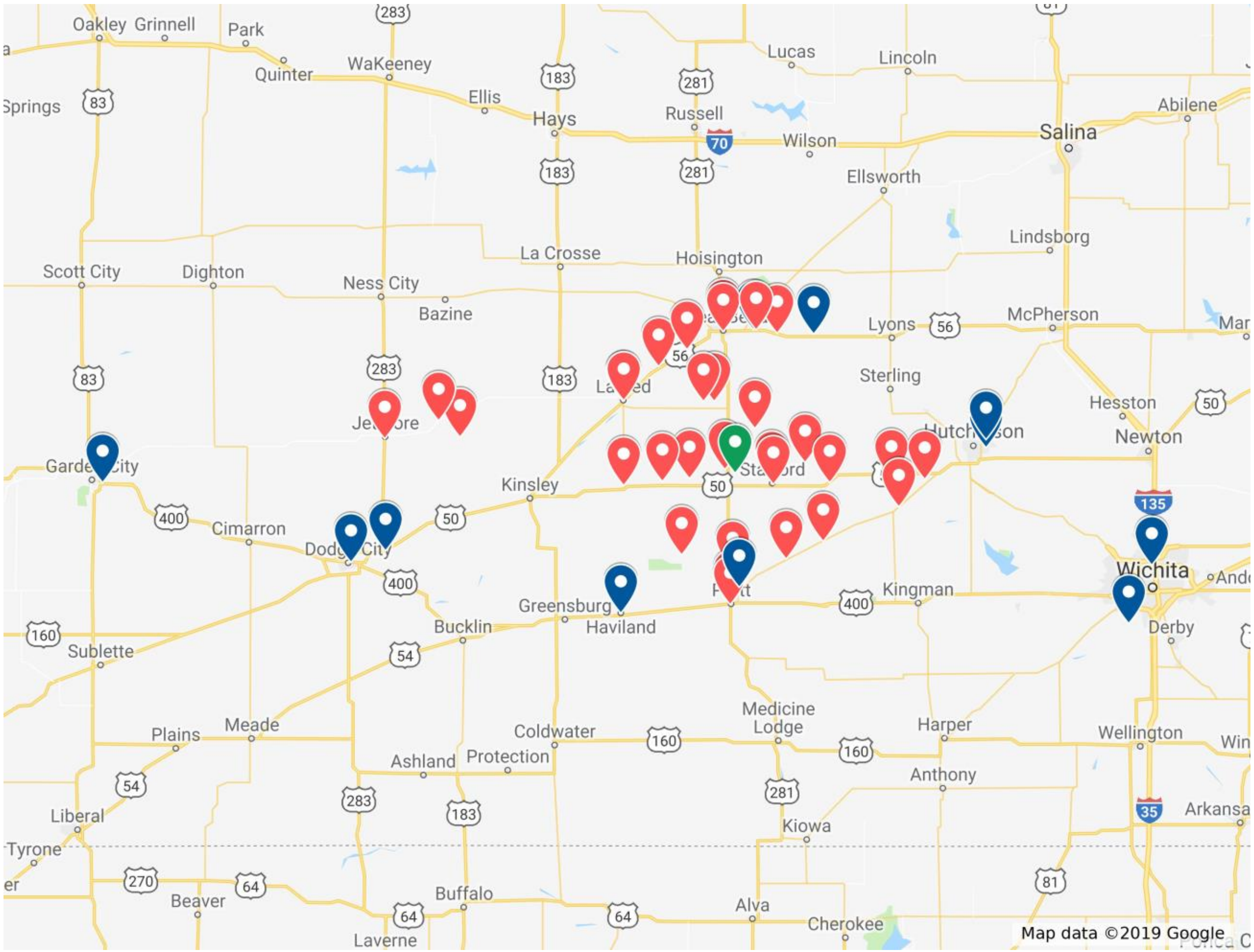
There are approximately 10 shuttle loader facilities owned by 7 companies in a 70 mile radius of Stafford County. These facilities have an aggregate storage capacity of approximately 70 million bushels of grain. The largest competitors for grain are located east of Stafford County, whom hold at least 60% of market share of grain storage capacity in Hutchinson and Wichita. In Hutchinson, there is one large competitor that holds storage capacity of more than 22 bushels of grain. Further south-east, in downtown Wichita, there are two other large competitors that hold more than 30 million bushels of grain storage combined. The second largest competitors are located approximately 60 miles west of St. John. In this area, two large companies are capable of storage and handling of 21 million bushels of grain combined. The third largest region of competition for Stafford is north of St. John. There are two mid-sized competitors that hold an aggregate of five million bushels of grain storage combined. Finally, south of St. John, there are two small sized competitors that own 4 million bushels of storage facility.

Country Elevators

In the area of study, there are approximately 12 grain cooperatives that have 33 locations scattered around the county and its proximities. These country elevators have storage capacity of more than 30 million bushels of grain combined. The two country elevators that dominate market share in Stafford County are Kanza Cooperative and Stafford County Flour mill whom hold a storage capacity of 13 and 2 million bushels of grain respectively.

Figure 3 illustrates the competitive landscape under which Stafford County operates.

Figure 3 Stafford County Map



Note: Labels in red and blue denote country and shuttle elevators respectively. Label in green denotes the location of the potential shuttle loader in Stafford County.

Chapter 5-Analysis and Results

Herfindahl-Hirschman Analysis

A competitive analysis helps to identify and evaluate an adequate volume output or throughput (measured in millions of bushels) to be considered for the proposed facility. The state of Kansas is characterized by a high shuttle train elevator density. Kansas has 5 to 6 times more grain handling facilities than Montana, another major grain producing state (Bekkerman, Taylor,etc.al 2014). As a consequence of the market power among grain exporting companies and a high concentration of shuttle loader facilities in the state, there is a distinct probability of lower cost savings and market share gains becomes very challenging to achieve by all market participants (terminal elevators, country elevators and farmers).

In order to examine the degree of market share competition in the proposed area of study, a competitive analysis framework has been conducted for Stafford County to better illustrate the competitive landscape under which this county operates. The county does not have shuttle train loading facility. However, the BNSF railway passes through the county seat of St. John, Kansas. Stafford County has two main country elevators that currently operate in the area: Kanza Coop and Stafford County Flour Mill whom have a grain storage capacity of thirteen and two million bushels, respectively. For the purposes of the competitive analysis framework, these country elevators are considered to be potential suppliers and a part of the supply chain. As such, these country elevators are ruled out of the competitive analysis.

The competitive landscape for Stafford County includes competitors in the surrounding counties. A reviewer of the potential challengers indicates there are eleven main shuttle loaders located on approximately 70 mile radius from the county. A proposed shuttle loading facility will likely compete for the origination of grain potentially sourced from cooperatives, country elevators and/or farmers. These competitors are located in the following counties: (1) Barton-North, Pawnee-North-west, Reno-East, Ford-South-west, Sedgwick-South-east, Pratt-South and Hodgeman-East.

To evaluate the market concentration of shuttle loaders in the area, a Herfindahl-Hirschman Index (HHI) was calculated. This index is widely accepted to provide insight on market concentration of a given area, in this case Stafford and surrounding counties. This index is calculated by squaring the market share of each competing firm in a market and summing the resulting numbers. The range of values this index can have is between 0 and 10,000. As the index approximates 10,000 the market will be more concentrated. In the other hand, as the index approaches 0, it signifies a less concentrated market.

The general form of the HHI Index is:

$$H = \sum_{i=1}^{n} S_i^2$$

Where s = market share of firm "i"

The HHI Index for Stafford is 2959. This reflects a highly concentrated industry where the top three companies hold 91% market share in the proposed area. As a result, the proposed facility (to be built in St. John's in Stafford County) will be tasked to gain market share from currently established facilities (three of which control a large portion of market share); consequently, this indicates that the market share assumptions on volume throughput of the proposed facility should be fairly conservative. Within the county, market share assumptions could be more optimistic contingent on the facility counting on the support of an alliance with local cooperatives or mid to large sized producers to market their grain.

Porter's Five Forces Analysis

Industry Rivalry (High)

The shuttle train loader business represents a highly concentrated market in the South-central region of Kansas. Considering a 70 mile radius of St. John, Kansas, there are a total of 11shuttle train elevators with multi-commodity storing and handling capabilities and an aggregate storage capacity of approximately 70 million bushels of grain. The top three companies whom own an aggregate of 5 elevators located east of St. John represent 88 percent of the total regional market share. As a result, minimum annual volume throughput requirements (5 annual turns or more) become extremely challenging to achieve, given the amount of grain storage capabilities of competitors.

Supplier Power (High)

According to KDA, there are approximately 536 farms accounting for roughly 500 thousand acres in Stafford County. Majority of the farms that devote their business focus to grain production, rely on two main country elevators to store, market and process their commodities: Kanza cooperative and Stafford County Flour Mill. These two local elevators engage in the business of processing and marketing mainly wheat, corn and milo. They have an aggregate storage capacity of 15 million bushels of grain. Kanza Co-op' share is 86 % of the market while the remaining 14 % corresponds to the flour mill. Farmer's switching costs from these suppliers is very high given these two country elevators are capable of storing 98% of grain production. In addition, there is a close and well-established relationship between local farmers and these country elevators, thus, the supplier power they would exert on the terminal elevator is significant. Successful origination of grain from these elevators should be a result of a well-established relationship, long term objectives of grain marketing and, in addition, basis premium bids would need to be present as an economic incentive of doing business. To a lesser extent, the owners of the proposed facility in the county can generate support from other two cooperative elevators located in the north-west region of the county, whom are Pawnee and Great Bend cooperatives.

<u>Buyer power (Medium)</u>

Buyers of wheat and corn from the proposed terminal elevator would be mainly out of state wheat processing mills (located in Oklahoma, Texas), livestock feeders located in the Texas panhandle, and export terminal elevators (Gulf, Louisiana and the Pacific North-west) whom would want to expand their origination footprint in Kansas to satisfy their global network operations. To a lesser extent, there would be local demand for corn from regional feedlots (such as Golden Belt Feeders, Dillwyn Feedyard and G&S Feeders) and an ethanol plant (Pratt Energy LLC) located in the proximities of St. John and surrounding counties. Future local demand could be enhanced with the new generation ethanol mill being built by The Anderson's in Colwich, Kansas (north-west of Wichita) scheduled to launch in May of 2019.

<u>Threat of substitutes & complements (Medium)</u>

Substitutes of grain terminal elevators would be country elevator hauling grain by trucking. Depending on the purpose of grain marketing, this could be high (low) threat. If the grain is going to be marketed mainly for export (out of state shipments), grain transport through rail proposes better economic incentives. If the grain is going to be marketed mainly to satisfy local demand, then country elevators are a high threat. The supply of grain (either for local or export demand) will be dependent on the forecasted net ending stocks for that given area. If net stocks are positive, then grain is available for export, otherwise, they are available for local demand only.

Complement: Railroad car availability. If there is scarce availability of railroad cars, that would affect negatively on the throughput of the terminal elevator. On the other hand, if there are plentiful cars, this will allow for a consistent and smooth flow of product through rail-lines assuming there is enough volume available for transportation.

Threat of new Entrants (Low)

Shuttle loader facility is a capital-intensive investment that requires a minimum of 16 to 20 million dollar investment on a 2 million bushel facility. New entrants are constrained mainly by high capital requirements. In addition, a new entrant would have to compete for market share with an already well-developed market composed mainly by local cooperatives and multinational corporations.

There are three main requirements in order for a new shuttle loader to be established on a given area:

- Access to capital
- Grain density that justifies minimum monthly/annual shuttle train volume requirements
- Relationship with Railroad
- Payback period of 4 to 10 years maximum

Capital requirement is a barrier to smaller participants (co-ops and regional grain companies). Return on investment (ROI) is a barrier for large corporations whom require greater returns values than regional grain companies.

Relationships both with traders and railroads are a barrier for a brand new entrant (with no previous experience in the industry).

Financial Analysis

This section focuses on the financial investment analysis for the proposed shuttle loader facility in Stafford County. The section will be organized as follows: first, a conservative pro-forma income statement is presented as a base model for the project detailing all realistic assumptions considered to construct a facility; Secondly, an evaluation of the riskiness of key variables will follow through the use of various scenarios and sensitivity analyzes; Lastly, an evaluation of the net present value, through projected annual cash flows, will be presented to determine the feasibility of the project under normal and volatile market conditions.

The base model under which the pro-forma income statement has been constructed has considered three main assumptions. First, volume throughput (for wheat and corn) has been estimated based on the previously discussed extraction rate methodology. It is important to note that the "hidden" or implicit assumption of the extraction rate is that net ending stocks for the region are assumed to be positive throughout the ten year investment period. In other words, a positive ending stock for corn and wheat provides the grain trader with incentive to export grain out of the state rather than to import (there is a surplus of local grain). A negative ending stock provides incentives to import grain (there is a shortage of local grain). The latter option has not been considered a possible event in this analysis. The extraction rate for wheat was roughly 23.19% while the rate for corn was 17%. This aligns with export dynamics found in previous studies favoring a higher export rate of wheat versus corn for the state of Kansas (Taylor 2017).

The second assumption (considered, arguably, the most important one), refers to the anticipated gross profit margin estimates measured for the life cycle of the investment period. The gross profit margin for grain trading is defined as:

$$Max_x \ (G.Profit) = \sum_{i=1}^{n} (Ep_e \, f(x) - Ep_o f(x) - Et_c \, f(x))$$

Where Ep_e represents the expected export price, Ep_o represents the expected origination price, Et_c represents the expected transportation cost (composed of tariff rate, surcharge and railcar bids) and $f(x)$ represents the expected volume throughput. The two most volatile components of the gross profit equation are the commodity price spread (export and origination price difference) and the railcar bids which are traded on a daily basis. The tariff rates and surcharge fees are more stable and do not fluctuate as often.

In order to estimate the gross profit margin of grain trading for corn and wheat, a commonly used method in the finance literature supports incorporating a portfolio analysis to analyze investment strategies. A time series data on daily gross profit margin values was gathered for both grain commodities for the last eight crop years (2010-2017). Understanding supply and demand fundamentals for grain commodities were vital to the further treatment of the data. Assuming no external conditions apply to grain prices other than seasonality of grains, it can be concluded that prices are expected to be the lowest during harvest time and the highest during planting and pre-harvest months. This is explained by during harvest, on average, there is a surplus of grain in the market, thus, suppressing the prices at the lowest levels and providing no incentive to the farmer or country elevator to market grain at that time. In contrast, during planting and post-planting periods, the supply of grain can be expected to be low, thus, generating higher prices and greater incentives to market grain. Taking into account the seasonality of grain assumption, the time series data has been segmented based on the different marketing periods during a crop year to allow for the estimation of gross profit margins. These marketing periods are defined as: harvest, planting, post-planting and pre-harvest. As a result, a series of four gross profit margin outcomes have been derived for the past eight marketing years. These four outcomes are considered portfolio assets (A through D) and will result in a weighted average portfolio return adjusted for risk. Figure 9 through 11 show portfolio returns for corn and wheat for selected marketing years. The third and final assumption refers to the decision mix of trading versus storing grain. At any given point in time, every trader, elevator manager and farmer must decide to either market or store grain. The decision on whether to store or to trade depends mainly on the market incentives. If there is a carry in the market, and if that carry revenue is sufficient to cover storage and interest costs (and leave a margin for positive return), then the decision maker will decide to store. Alternatively, if there is an arbitrage opportunity (otherwise referred to a positive price spread) to be made by originating grain at certain location and market the same grain at a destination point at a profit, then the decision maker will decide to sell or trade grain. The challenge for the trader is to estimate the future benefits; nevertheless, it can be determined with a degree of certainty the purposes of a country elevator versus a shuttle elevator is to decide on adequate mix of grain storage and grain traded. Country elevators were built in close proximities to farming location, often within 15 to 30- mile radius to provide storage capabilities to farmers whom do not have enough on farm storage for their grain. On the one hand, these types of elevators serve the purposes of providing farm storage as well as market a customer’s grain regionally. On the other hand, shuttle train elevators are considered high-speed load-out facilities specifically designed for long-haul grain transportation through the use of rail assets. Now, this does not imply that shuttle elevators may not engage in speculative storage activities, but if these type of elevators plan to be around for a long time, they are not going to survive in the market just by storing grain most of the time. Industry experts affirm that a conventional country elevator does not turn its inventory more than 1.5 times per year. On the contrary, country elevators generally turn their inventory 4 to 8 times per year (private source). A private grain consultant declared that “if I had built a shuttle train elevator, I would expect to be trading grain 90 percent of the time”. After careful further considerations, he adjusted his trading expectations to a 65 to 75 percent range due to the fact that the market will not necessarily incentivize you to trade almost 11 months out of the 12 in a given marketing year. This study uses a more conservative estimate for the use of the shuttle loading facility. Sixty five percent of the time the asset will be spent on merchandising grain. Thirty five percent of the time the asset would be used for grain storage.

The following tables will provide the decision maker with an understanding of the potential cash flow to be generated under three different scenarios: base, optimistic and pessimistic.

Table 9 Base Income Pro-forma Statement

P&L Forecast	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Volume Total	7,262	7,407	7,555	7,706	7,860	8,017	8,178	8,341	8,508	8,678
Wheat										
Gross Margin**	$0.20	$0.20	$0.20	$0.21	$0.21	$0.22	$0.22	$0.22	$0.23	$0.23
Handling cost**	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04
Net Margin**	$0.15	$0.16	$0.16	$0.17	$0.17	$0.17	$0.18	$0.18	$0.19	$0.19
Net Margin %	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%
Corn										
Gross Margin**	$0.29	$0.29	$0.30	$0.30	$0.31	$0.32	$0.32	$0.33	$0.34	$0.34
Handling cost**	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Net Margin**	$0.23	$0.24	$0.24	$0.25	$0.25	$0.26	$0.27	$0.27	$0.28	$0.29
Net Margin %	5.3%	5.4%	5.6%	5.7%	5.8%	6.0%	6.1%	6.3%	6.4%	6.6%
Storage Return**	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13
Total Net Margin*	**$1,776**	**$1,833**	**$1,893**	**$1,955**	**$2,019**	**$2,085**	**$2,153**	**$2,224**	**$2,298**	**$2,374**
SG&A*	$908	$926	$944	$963	$982	$1,002	$1,022	$1,042	$1,063	$1,085
EBITDA*	**$868**	**$908**	**$949**	**$992**	**$1,036**	**$1,083**	**$1,131**	**$1,182**	**$1,235**	**$1,290**
Interest*	$223	$223	$223	$223	$223	$223	$223	$223	$223	$223
Taxable Income*	$645	$685	$726	$769	$814	$860	$909	$959	$1,012	$1,067
Tax*	$65	$68	$73	$77	$81	$86	$91	$96	$101	$107
Net Income*	**$581**	**$616**	**$653**	**$692**	**$732**	**$774**	**$818**	**$863**	**$911**	**$960**

Table 10 Optimistic Income Pro-forma Statement

P&L Forecast	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Volume Total	7,954	8,113	8,276	8,441	8,610	8,782	8,958	9,137	9,320	9,506
Wheat										
Gross Margin**	$0.20	$0.20	$0.20	$0.21	$0.21	$0.22	$0.22	$0.22	$0.23	$0.23
Handling cost**	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04
Net Margin**	$0.15	$0.16	$0.16	$0.17	$0.17	$0.17	$0.18	$0.18	$0.19	$0.19
Net Margin %	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%
Corn										
Gross Margin**	$0.29	$0.29	$0.30	$0.30	$0.31	$0.32	$0.32	$0.33	$0.34	$0.34
Handling cost**	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Net Margin**	$0.23	$0.24	$0.24	$0.25	$0.25	$0.26	$0.27	$0.27	$0.28	$0.29
Net Margin %	5.3%	5.4%	5.5%	5.7%	5.8%	6.0%	6.1%	6.3%	6.4%	6.6%
Storage Return**	$0.17	$0.17	$0.17	$0.17	$0.17	$0.17	$0.17	$0.17	$0.17	$0.17
Total Net Margin*	**$2,279**	**$2,349**	**$2,421**	**$2,496**	**$2,573**	**$2,652**	**$2,735**	**$2,820**	**$2,909**	**$3,000**
SG&A*	$908	$926	$944	$963	$982	$1,002	$1,022	$1,042	$1,063	$1,085
EBITDA*	**$1,371**	**$1,423**	**$1,477**	**$1,532**	**$1,590**	**$1,651**	**$1,713**	**$1,778**	**$1,845**	**$1,916**
Interest*	$223	$223	$223	$223	$223	$223	$223	$223	$223	$223
Taxable Income*	$1,149	$1,200	$1,254	$1,310	$1,368	$1,428	$1,490	$1,555	$1,623	$1,693
Tax*	$115	$120	$125	$131	$137	$143	$149	$156	$162	$169
Net Income*	**$1,034**	**$1,080**	**$1,129**	**$1,179**	**$1,231**	**$1,285**	**$1,341**	**$1,400**	**$1,460**	**$1,524**

Table 11 Pessimistic Income Pro-forma Statement

P&L Forecast	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Volume Total	6,569	6,700	6,835	6,971	7,111	7,253	7,398	7,546	7,697	7,851
Wheat										
Gross Margin**	$0.20	$0.20	$0.20	$0.21	$0.21	$0.22	$0.22	$0.22	$0.23	$0.23
Handling cost**	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04
Net Margin**	$0.15	$0.16	$0.16	$0.17	$0.17	$0.18	$0.18	$0.18	$0.19	$0.19
Net Margin %	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%
Corn										
Gross Margin**	$0.29	$0.29	$0.30	$0.30	$0.31	$0.32	$0.32	$0.33	$0.34	$0.34
Handling cost**	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Net Margin**	$0.23	$0.24	$0.24	$0.25	$0.25	$0.26	$0.27	$0.27	$0.28	$0.29
Net Margin %	5.3%	5.4%	5.6%	5.7%	5.8%	6.0%	6.1%	6.3%	6.4%	6.6%
Storage Return**	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08
Total Net Margin*	**$1,330**	**$1,377**	**$1,425**	**$1,475**	**$1,527**	**$1,581**	**$1,637**	**$1,695**	**$1,755**	**$1,818**
SG&A*	$908	$926	$944	$963	$982	$1,002	$1,022	$1,042	$1,063	$1,085
EBITDA*	**$423**	**$451**	**$481**	**$512**	**$545**	**$579**	**$615**	**$653**	**$692**	**$733**
Interest*	$223	$223	$223	$223	$223	$223	$223	$223	$223	$223
Taxable Income*	$200	$228	$258	$289	$322	$356	$392	$430	$469	$510
Tax*	$20	$23	$26	$29	$32	$36	$39	$43	$47	$51
Net Income*	**$180**	**$206**	**$232**	**$260**	**$290**	**$321**	**$353**	**$387**	**$422**	**$459**

* Value in millions
**Value in dollars per bushel

The year one volume considered at the base model was estimated through the extraction rate methodology which yielded an approximate average yearly shipment of 4.57 and 2.68 million bushels for wheat and corn respectively. A growth rate of 2 percent was considered for the years 2 through 10 aggregating a total forecast of 87 million bushels shipped during the lifetime of the investment. Handling cost for wheat and corn were four and six cents per bushel respectively. Fixed costs were approximately 13 cents per bushel totaling 908 million dollars for the 1st year. Storage revenue was calculated to be 3 cents per month, and, adjusted for four month storage period, totaled 12.6 cents per bushel per year. The gross profit margin (measured in dollars per bushel) was derived from a portfolio analysis conducted on the 2016-17 marketing year. The reason why this specific year was considered was due to the fact that prices (for railcars) were found to be less volatile as compared to previous marketing years, such as the railcar bid price spike in 2014.

Table 12 shows the results on the portfolio analysis conducted for the 2016-17 year for both commodities.

Table 12 Portfolio Analysis for selected crop marketing years

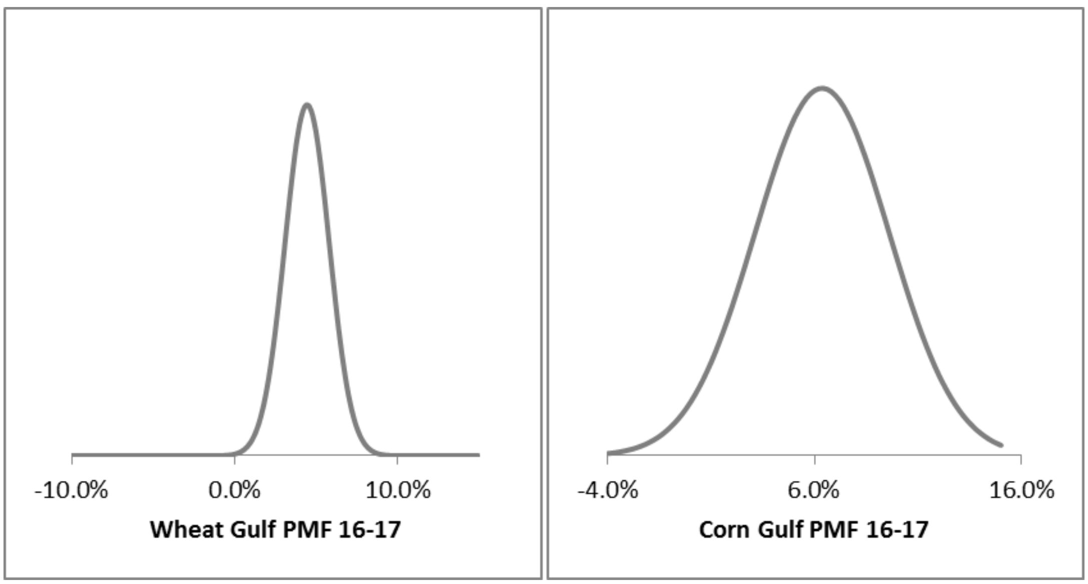
Wheat Portfolio 2016-17	A	B	C	D
Avg Return ($/bu)	8.2%	1.0%	1.2%	6.1%
SD ($/bu)	5.90%	3.19%	3.11%	4.95%
Sharpe Ratio	1.39	0.30	0.39	1.22
Portfolio Weight	28.24%	24.12%	20.00%	27.65%
Portfolio Return	4.5%			
Portfolio Variance	0.018%			
Portfolio Standard Deviation	1.36%			
Portfolio Sharpe Ratio	3.29			

Corn Portfolio 2016-17	A	B	C	D
Avg Return ($/bu)	10.8%	-0.1%	9.2%	0.1%
SD ($/bu)	6.15%	3.83%	10.48%	2.93%
Sharpe Ratio	1.76	-0.03	0.88	0.05
Portfolio Weight	32.75%	18.13%	30.41%	18.71%
Portfolio Return	6.4%			
Portfolio Variance	0.105%			
Portfolio Standard Deviation	3.24%			
Portfolio Sharpe Ratio	1.96			

From the results of the portfolio analysis, it is inferred that the greatest gross profit margin (or return) is when a grain trader arbitrages during the harvest months (asset A) for both wheat and corn respectively. In other words, if the trader is able to originate grain during harvesting period (when prices are assumed to be lower) and sell them at a premium at main export markets (in this case, Gulf of Mexico), he/she could maximize profits. In reality, no country elevator or farmer will have the incentive to sell its commodity during harvesting period. In order to adjust the assumptions to reality, the study assumed a 13 cent per bushel premium that the trader must pay on top of the published market price (elevator grain bid) to realistically execute the trade during this period. This premium price is what shuttle train loaders bid (on average) versus a regular country elevator given the competitive advantage they have over freight rates (Taylor 2016). The portfolio weight has been estimated by calculating the probability of making positive returns on each asset for the 2016-17 marketing period. The portfolio variance and standard deviation have been calculated by analyzing the correlations between each possible asset combination. Finally, the portfolio sharp ratio provides an indication of the risk-adjusted return and it is calculated by dividing the portfolio return by the volatility (or standard deviation). The greater the value of the sharp ratio, the more attractive the return adjusted for risk.

In order to evaluate the downside risk potential of gross profit margin loss over a given period of time, it is necessary to understand the probability distribution and volatility (otherwise known as standard deviation) of wheat and corn margins. Figure 4 shows the probability distribution for these commodities for the 2016-17 year assuming a normally distributed data.

Figure 4 Net Margin Distribution by Commodity



The distribution of both commodities show a bell shaped curve signifying a normally distributed probability mass function. Given this assumption, a parametric value-at-risk (Var) measure has been computed to calculate the downside risk of potential loss under three significance levels. Table 13 shows the VAR for selected commodities during the 2016-17 marketing year.

Table 13 2016-17 Value-at-Risk Analysis for selected confidence intervals

Financial Impact	Wheat $ Loss	Corn $ Loss	Total $ Loss
VAR 99%	($21,882)	($54,686)	($76,568)
VAR 95%	($16,650)	($41,609)	($58,258)
VAR 90%	($13,974)	($34,922)	($48,895)

A Var of 99% explains that for a given marketing year, there is a 99 percent certainty that total loss will not exceed $76,658 dollars under normal market conditions. Similarly, one percent of the time, the suggested portfolio will lose at least $76,658 dollars per year. Similar conclusions can be derived for other confidence intervals. The objective of conducting a Var simulation is to understand to what extent the base model' gross margin projections could be relaxed given past volatilities. In other words, it provides the investor an idea on how volatile the returns could be on a given year.

In addition to Var simulation, it is necessary to conduct sensitivity analysis to understand under what range of key variables is the project making positive and/or negative returns. In the case of grain merchandising activities, the most sensitive variables to consider are the commodity origination price and the total transportation cost (tariff, surcharge and railcar bids). Figure 5 and Figure 6 depict sensitivity analysis for these variables under the four asset conditions (A through D) for wheat and corn respectively.

Figure 5 2016-17 Corn Sensitivity Analysis

Transportation Cost				A) Harvest								B) Planting			
	3.27	3.38	3.49	3.60	3.71	3.82	3.93		3.19	3.30	3.41	3.52	3.63	3.74	3.85
1.06	0.20	0.09	0.02	0.13	0.24	0.35	0.46	1.12	0.25	0.36	0.47	0.58	0.69	0.80	0.91
1.09	0.17	0.06	0.05	0.16	0.27	0.38	0.49	1.15	0.28	0.39	0.50	0.61	0.72	0.83	0.94
1.12	0.14	0.03	0.08	0.19	0.30	0.41	0.52	1.18	0.31	0.42	0.53	0.64	0.75	0.86	0.97
1.15	0.11	0.00	0.11	0.22	0.33	0.44	0.55	1.21	0.34	0.45	0.56	0.67	0.78	0.89	1.00
1.18	0.08	0.03	0.14	0.25	0.36	0.47	0.58	1.24	0.37	0.48	0.59	0.70	0.81	0.92	1.03
1.21	0.05	0.06	0.17	0.28	0.39	0.50	0.61	1.27	0.40	0.51	0.62	0.73	0.84	0.95	1.06
1.24	0.02	0.09	0.20	0.31	0.42	0.53	0.64	1.30	0.43	0.54	0.65	0.76	0.87	0.98	1.09
1.27	0.01	0.12	0.23	0.34	0.45	0.56	0.67	1.33	0.46	0.57	0.68	0.79	0.90	1.01	1.12
1.30	0.04	0.15	0.26	0.37	0.48	0.59	0.70	1.36	0.49	0.60	0.71	0.82	0.93	1.04	1.15
				C) Pre-Harvest								D) Pre-Planting			
0.41	2.91	3.02	3.13	3.24	3.35	3.46	3.57	0.01	3.23	3.34	3.45	3.56	3.67	3.78	3.89
1.14	0.41	0.30	0.08	0.25	0.69	1.24	1.90	1.15	0.27	0.38	0.49	0.60	0.71	0.82	0.93
1.17	1.93	2.04	2.26	2.59	3.03	3.58	4.24	1.18	0.30	0.41	0.52	0.63	0.74	0.85	0.96
1.20	4.27	4.38	4.60	4.93	5.37	5.92	6.58	1.21	0.33	0.44	0.55	0.66	0.77	0.88	0.99
1.23	6.61	6.72	6.94	7.27	7.71	8.26	8.92	1.24	0.36	0.47	0.58	0.69	0.80	0.91	1.02
1.26	8.95	9.06	9.28	9.61	10.05	10.60	11.26	1.27	0.39	0.50	0.61	0.72	0.83	0.94	1.05
1.29	11.29	11.40	11.62	11.95	12.39	12.94	13.60	1.30	0.42	0.53	0.64	0.75	0.86	0.97	1.08
1.32	13.63	13.74	13.96	14.29	14.73	15.28	15.94	1.33	0.45	0.56	0.67	0.78	0.89	1.00	1.11
1.35	15.97	16.08	16.30	16.63	17.07	17.62	18.28	1.36	0.48	0.59	0.70	0.81	0.92	1.03	1.14
1.38	18.31	18.42	18.64	18.97	19.41	19.96	20.62	1.39	0.51	0.62	0.73	0.84	0.95	1.06	1.17

Figure 6 2016-17 Wheat Sensitivity Analysis

Transportation Cost	A) Harvest								B) Planting						
	3.06	3.17	3.28	3.39	3.50	3.61	3.72		2.98	3.09	3.20	3.31	3.42	3.53	3.64
1.08	0.37	0.26	0.15	0.04	0.07	0.18	0.29	1.10	0.03	0.08	0.19	0.30	0.41	0.52	0.63
1.11	0.34	0.23	0.12	0.01	0.10	0.21	0.32	1.13	0.00	0.11	0.22	0.33	0.44	0.55	0.66
1.14	0.31	0.20	0.09	0.02	0.13	0.24	0.35	1.16	0.03	0.14	0.25	0.36	0.47	0.58	0.69
1.17	0.28	0.17	0.06	0.05	0.16	0.27	0.38	1.19	0.06	0.17	0.28	0.39	0.50	0.61	0.72
1.20	0.25	0.14	0.03	0.08	0.19	0.30	0.41	1.22	0.09	0.20	0.31	0.42	0.53	0.64	0.75
1.23	0.22	0.11	0.00	0.11	0.22	0.33	0.44	1.25	0.12	0.23	0.34	0.45	0.56	0.67	0.78
1.26	0.19	0.08	0.03	0.14	0.25	0.36	0.47	1.28	0.15	0.26	0.37	0.48	0.59	0.70	0.81
1.29	0.16	0.05	0.06	0.17	0.28	0.39	0.50	1.31	0.18	0.29	0.40	0.51	0.62	0.73	0.84
1.32	0.13	0.02	0.09	0.20	0.31	0.42	0.53	1.34	0.21	0.32	0.43	0.54	0.65	0.76	0.87
	C) Post-Planting								D) Pre Harvest						
	2.91	3.02	3.13	3.24	3.35	3.46	3.57		2.90	3.01	3.12	3.23	3.34	3.45	3.56
1.09	0.05	0.06	0.28	0.61	1.05	1.60	2.26	1.14	0.26	0.15	0.07	0.40	0.84	1.39	2.05
1.12	2.29	2.40	2.62	2.95	3.39	3.94	4.60	1.17	2.08	2.19	2.41	2.74	3.18	3.73	4.39
1.15	4.66	4.77	4.99	5.32	5.76	6.31	6.97	1.20	4.45	4.56	4.78	5.11	5.55	6.10	6.76
1.18	7.06	7.17	7.39	7.72	8.16	8.71	9.37	1.23	6.85	6.96	7.18	7.51	7.95	8.50	9.16
1.21	9.49	9.60	9.82	10.15	10.59	11.14	11.80	1.26	9.28	9.39	9.61	9.94	10.38	10.93	11.59
1.24	11.95	12.06	12.28	12.61	13.05	13.60	14.26	1.29	11.74	11.85	12.07	12.40	12.84	13.39	14.05
1.27	14.44	14.55	14.77	15.10	15.54	16.09	16.75	1.32	14.23	14.34	14.56	14.89	15.33	15.88	16.54
1.30	16.96	17.07	17.29	17.62	18.06	18.61	19.27	1.35	16.75	16.86	17.08	17.41	17.85	18.40	19.06
1.33	19.51	19.62	19.84	20.17	20.61	21.16	21.82	1.38	19.30	19.41	19.63	19.96	20.40	20.95	21.61

The values in rows (highlighted in white) represent the origination commodity price starting from the average price in each specific marketing period and increasing at a rate of up to 20 percent at the end of the table. For example, under the asset condition “harvest” in Figure 6, the commodity price ranges from $3.06 per bushel to $3.72 per bushel. The values in columns (highlighted in white) represent the transportation cost starting at the average cost per period and also increasing at a rate of up to 20 percent. In the same Figure 6, the transportation price ranges from $1.08 per bushel to $1.32 per bushel under the asset condition “harvest”. Finally, the values inside of the box (colored) represent the gross profit margin at each level of price and transportation cost. For example, under the asset condition “harvest” in Figure **6**, thirty seven cents (0.37) represents the gross profit margin per bushel of wheat priced at $3.06 per bushel and transportation cost of $1.08 per bushel. The variations of green found under the asset four conditions represent positive gross margins. Colors other than green represent a negative gross margin. An interpretation of the sensitivity analysis, suggest a greater opportunity to earn positive gross profit margins during the harvest and pre-harvest months.

The final step of the financial analysis is to understand if the presented cash flows derived from the projected pro-forma income statements do, indeed, generate positive net present values. Table 14 shows a summary of the net present values for each scenario, considering three payback periods and two building options.

Table 14 Net Present Value for selected payback periods

Building	CAPEX	Scenario	5 Year	10 Year	15 Year
Steel	$16,885,000	Base	($13,303,766)	($10,907,208)	($8,660,644)
		Optimistic	($11,470,843)	($7,581,854)	($4,117,978)
		Pessimistic	($14,927,469)	($13,856,706)	($12,694,737)
Concrete	$20,885,000	Base	($17,050,839)	($14,654,280)	($12,407,717)
		Optimistic	($15,217,915)	($11,328,926)	($7,865,051)
		Pessimistic	($18,674,541)	($17,603,779)	($16,441,809)

Summarizing the following table, it is observed that investors preferring a five year payback period would not find this particular investment attractive. The type of investors that would be considering this payback period are firms with a conservative investment philosophy, such as large multinationals corporations and national grain companies (own source). Investors looking at longer payback periods (10 and 15 years) are categorized as regional or local grain cooperatives. From the various private interviews conducted on this study, it is seen that local cooperatives are comfortable on a 10 year payback for steel bins. Consequently, observing the results, a 10 and 15 year period payback is also unattractive given it provides negative returns on all scenarios. Nevertheless, in reality, majority of investors would not be interested in such a long payback period (15 years) for a steel or concrete bin construction. As a result, at this particular point, all of the payback periods for all scenarios present negative net present values for the proposed project.

Up to this point, one hundred percent of capital expenditure costs have been considered to be incurred solely by the private investor. Nevertheless, if there is a real interest for a public-private partnership, some of the costs might be waived or, in other words, incurred by Stafford County. Table 15 illustrates the adjusted net present value tables if the county incurs track and land costs (approximately $5,885,000):

Table 15 Subsidized Net Present Value for selected payback periods

Building	CAPEX	Scenario	5 Year	10 Year	15 Year
Steel	$10,115,000	Base	($6,961,846)	($4,565,287)	($2,318,724)
		Optimistic	($5,128,922)	($1,239,933)	$2,223,942
		Pessimistic	($8,585,548)	($7,514,786)	($6,352,816)
Concrete	$14,115,000	Base	($10,708,918)	($8,312,360)	($6,065,796)
		Optimistic	($8,875,995)	($4,987,006)	($1,523,131)
		Pessimistic	($12,332,621)	($11,261,858)	($10,099,889)

A shown by the table, a five and ten year payback remains unattractive to private investors despite the "subsidy" of 5.8 million dollars provided by the county. Similarly, a 15 year payback period is also considered unattractive except for the optimistic scenario for a steel bin construction. Again, this particular scenario could become conceivable condition upon finding an investor that is willing to accept the 15 year payback period for this type of investment.

Given these results, the question becomes: what is the breakeven point for this investment? In other words, what level of volume throughput is considered sufficient to make this investment feasible? This study has found that approximately 20 million bushels of grain (10 inventory turns per year) would be necessary to breakeven at a 10 year payback period for steel bin construction. Table 16 illustrates the breakeven NPV's given at each payback period.

Table 16 Breakeven Net Present Values for selected payback periods

Building	CAPEX	Scenario	5 Year	10 Year	15 Year
Steel	$16,885,000	Base	($7,532,452)	$51,053	$6,947,915
		Optimistic	($3,725,264)	$6,890,495	$16,202,413
		Pessimistic	($11,505,415)	($7,086,198)	($2,709,550)
Concrete	$20,885,000	Base	($11,279,525)	($3,696,020)	$3,200,842
		Optimistic	($7,472,337)	$3,143,423	$12,455,341
		Pessimistic	($15,252,488)	($10,833,271)	($6,456,622)

The study has not found a reasonable justification on how the area of study could draw 20 million bushels of grain for the proposed shuttle facility in any given year. In fact, the most amount of volume throughput estimated out of this area was roughly 7.9 million bushels of grain (63% wheat and 37% corn) considering a 70 mile radius from the county seat St. John, Kansas.

Chapter 6-Project Finance

Capital structure options for long term investment projects can vary on a case-by-case basis. In this chapter, the focus is on laying out the potential financing options for this particular project. The proposed grain intermodal facility will be located south of St. John, Kansas, which has approximately 50 to 100 acres of land to support a shuttle loader facility of two million bushels of storage capacity.

Shuttle elevator capital expenditure costs

Considering the fact that this intermodal facility is classified as a terminal grain elevator, the two potential types of elevators designs that would be best suited to maintain the standard of a high-load-out facility are the commercial steel bins and concrete annex bins.

The commercial cylindrical steel bins are composed corrugated steel flat bottomed for dry storage of grain and other products. They are considered heavy duty bins with thicker walls and additional reinforcements to withstand repeated filling, emptying, stirring and mixing. They are specially designated for commercial and industrial use (SAMA 2015). The average life expectancy of these types of bins is 20 years and the loading/unloading efficiency rate is 60,000 bushel per hour. The proposed facility will be composed of four, 500,000 bushel capacity, cylindrical bins equipped to store mainly wheat, corn and milo.

The concrete annex bin has a longer life expectancy (40 years) than any other modalities of bins (i.e. crib bins, silos, hopper bins, frame annex, cylindrical bins). This concrete elevator bin or annex is designed especially to store grain. It is composed by a concrete foundation, concrete pads with piles, concrete floor, walls, roof and tunnels. The annex bin is filled by using an elevator leg to lift the grain and then using spouting or conveyors to move the grain from the elevator to the annex (SAMA 2015). The annex will be equipped by a variety of clean out systems which will serve the purpose of cleaning the grain to then send it onto a conveyor which will in turn return the grain back to the elevator. The proposed annex will be composed of four bins each holding approximately 500,000 bushels of grain. In addition, there will be two bins that will serve as support bins. The maximum loading/unloading efficiency rate this annex can provide is 90,000 bushel/hour compared to that of a steel bin which tops at 60,000 bushel per hour. According to SAMA's cost guide, the base rate are prorated on a dollar per bushel basis and include the foundation, concrete pad, tunnels, concrete structure, steel work and equipment (including conveyors , spouting, distributors, gates, clean out systems, electrical) required to operate the elevator. In summary the base rate is composed of four items, (1) Structural Rate, (2) Equipment Rate, (3) Intersecting Rate, and (4) Jump Form Rate. For a steel bin construction, it is estimated that the overall construction and equipment costs will oscillate between five to six dollars per bushel. For a concrete annex bin, the cost will oscillate between seven to ten dollars per bushel. The variability in costs depends mainly on the type of material handling equipment, electrical/automation, aeration, and others. This estimate includes basic cost considerations such as material and labor, truck receiving, fill/empty equipment, bulkweigher, elevator legs and others.

In addition to these costs, there will be a cost of approximately 4 to 6 million dollars related to trackage and switching. There are two main track designs accepted by the railroads: a loop track and a linear/ladder track. A loop track requires approximately 150 to 200 acres depending on the infrastructure the customer places on the land in addition to the track. The loop track has an extension of 8,500 to 10,000 feet and it requires from 3 to 5 switches depending on the layout. A linear track requires approximately 50 to 100 acres and has an extension ranging from 11,000 to

15,000 feet depending on the amount of storage tracks the customer wants to install. The linear track will also require anywhere from 3 to 5 switches. The average track cost per linear foot ranges from $250 to $350. Each internal customer switch costs approximately $170,000 and switch heaters around $100,000. The powered main line switch costs $1,500,000, in addition to the derail ($50,000) and the engineering design of the track ($75,000).

A base track design requires three internal (customer switches), one mainline switch, one switch heater (connected to the mainline) and one derail (attached to the mainline). In addition, an average cost per feet of track built of $300. Given these assumptions, the approximate costs of a loop (8500 ft) and linear (11,000 ft) track are $4,785,000 and $5,535,000 respectively. Given the land availability in the area, this study will consider the implementation of a linear track. Finally, land costs would vary depending on dryland versus irrigated land. This variation ranges from 2000 to 5000 dollars per acre approximately. This study considered an average land cost per acre of $3500, thus, for a 100 acre facility, estimated land costs would be $350,000.

In summary, assuming a construction cost of $5.50 per bushel and $7.50 per bushel for steel and concrete respectively and, in addition, a cost of $5,535,000 for a linear track, and finally, an average land cost of $3500 per acre, the overall capital expenditure costs (Capex) are approximately $16,885,000 and $20,885,000 for steel and concrete construction.

Given the estimated Capex for this project, there are four capital structure options that will be proposed to finance the project. A cost of capital of 6.75% will be considered for all capital structures presented. The first proposal, namely, Project A would be 100% debt finance, project B will take the form of 50% debt and 50% equity, project C will take the form of 25% debt and 75% equity and, finally, project D will be 100% equity finance.

Potential investors and why they invest

Intermodal grain facilities have been built by cooperatives, independent investors and multinationals. However, the objective and purposes behind the decision on building differs among these private stakeholders. The main incentive for a grain cooperative to invest in shuttle loaders is to gain access to markets outside of the local area, typically export markets (Kowalski 2014). This motivation is explained by the idea of diversification, often referred as the "three legged stool" which includes feed, ethanol and exports. Given most country elevators may have serviced feed and ethanol through their current operations, they are not able to serve export markets without a shuttle loader facility, so they ultimately resource to the investment on them (Kowalski 2014). Multinational companies have different visions and objectives when considering an investment on a shuttle loading facility. These large agribusiness corporations have access to export markets, own sufficient infrastructure assets worldwide and are financially stable to undertake large investment propositions (Kowalski 2014). Nevertheless, the main factor these businesses lack is access to direct origination of grain mainly from the Midwest and Grain Belt region. As a result, they consider the investment on shuttle loaders as an opportunity to directly source grain, and as a consequence, the benefits would be securing local supply of product, enhancing stronger relationships with suppliers and reducing the cost of acquiring grain.

Chapter 7-Conclusion and Recommendation

A feasibility assessment is defined as “the disciplined and documented process of thinking through an idea from its logical beginning to its logical end to determine its practical viability potential, given the realities of the environment in which it is going to be implemented” (Amanor 2010). In this study, a feasibility study has been conducted to determine the economic viability of the investment of a grain shuttle loader in the rural community of Stafford County. Business ventures in grain shuttle loader facilities are an integral part of the economic development of rural communities in the U.S. This study analyzes the venture of these facilities particularly in a rural county of the state of Kansas. The primary question this study aimed to answer is: “What are the investment options to be considered for an investment in a Shuttle Loader in Stafford County?

Results on the HHI Index suggest that the area of study is composed of a Bertrand Oligopoly Market. This shows that multinational and cooperative firms will engage in fierce grain basis bids in the pursuit to originate grain from the area. As a result, the main strategy to gain market share is to provide competitive commodity market prices to clients. This will depend entirely on the ability of firms to generate extra savings from shuttle shipments through efficient freight strategies (railcar bids), reduced time windows for loading cars, and minimum volume shipments to get access to lower tariff rates. In addition, results from the Porter’s Five Forces Model suggest that the industry rivalry and supplier power are high. Both of these models helped identify the risks of competition when determining market share assumptions for the project. In other words, market share extraction rates were adequately adjusted based on the the degree of competition observed in the area of study, derived from the HHI and Five Forces Model.

The financial results presented in Chapter 5-Analysis and Results suggest that there is no conclusive evidence to justify an investment of this type at this particular time period. The net present values (NPV) calculated for 5 and 10 year payback periods align with industry expectation. However, the results support negative NPV values in all scenarios presented (base, optimistic and pessimistic).

In addition, potential subsidies of approximately $5.8 million dollars provided by the County to alleviate a portion of the capital expenditure costs, proved to be insufficient to a positive net present value. Furthermore, the volume of grain needed for the proposed facility (considering a 70 mile radius of St. John) proved to be inadequate to sustain minimum income levels that would support a shuttle loading facility overtime.

Likewise, 2018-20 outlook for hard red winter suggest reduction in export numbers by about 35 million bushels. Similarly, corn outlook shows a 25 million bushel reduction in corn used for ethanol and 75 million bushels reduction in corn exports (WASDE 3/2019). These demand fundamentals have a direct effect on grain origination dynamics for Stafford County given they provide a negative outlook on the potential future growth in long-haul grain transportation for the area. If this trend continues to persist overtime, the investment decision of a grain shuttle loader becomes less and less attractive to investors.

An alternative investment in businesses that complement a shuttle loading facility could potentially generate enough income to reduce the payback period. This might include a third-party Logistics Company that provides warehousing services for farm inputs (chemicals, fertilizers, and others). Nevertheless, this study found no public data to quantify the potential benefits of this particular business venture.

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Chapter 8-Limitations and Future Research

- Transportation costs (including railcar bids): were extracted from USDA Transportation Service which collected costs from all railroads across time and reported an industry average/benchmark. These costs may vary on a case by case basis and is not a perfect reflection of the reality Stafford County may face. This is going to vary depending on the negotiation with railroads and the ability to trade freight efficiently.
- Export Markets: For simplicity, two major export markets were considered to conduct the financial analysis that would derive the anticipated gross profit margins projections. In reality, grain traders are considering not only these markets, but any other regional or national markets in which they can arbitrage and do long-haul transportation of grain. Markets that could be further included in the analysis are the flour mills in Oklahoma, Illinois and export markets in Mexico.
- Product Selection: By analyzing the grain density in Stafford County, it was concluded that for this study, the main commodities that were going to be commercialized for the proposed facility were corn and wheat. These two grains serve the main economic activities in the area which is livestock feed and milling and are also exportable commodities.
- Strategic Mix: The trader or export elevator manager faces two main decisions every day: to store or to trade? For the purposes of this elevator, we have determined that at least 65 percent of the time he (or she) would trade rather than store. Given that this is a terminal elevator which is devoted for export markets, inventory turnovers are higher than regular country elevators. As a result, there is more incentive to trade than to store (on average) for two main reasons: to reduce debt burden & payout investment faster and to maximize

the utilization of the rail asset (which represents approximately 30 percent of the overall capital expenditure costs).

- Sensitivity analysis: ranges have been determined based on recommendation of CoBank Chief Economist Kowalski, whom suggests a range of up to 20 percent should be considered when conducting sensitivity analysis of key variables that affect the success of shuttle loader projects
- Volume throughput proxy: There is no public information regarding elevator warehouse receipts or volume of grain shipped for the state of Kansas. Thus, in order to approximate the throughput opportunity the new facility could potentially capitalize on, this study relied on Mikel Taylor's study on: "Market Concentration in Wheat Market Industry" which reported an aggregate value on total wheat shipments for the state of Kansas during the 2004-2013 period. Subsequently, the ratio of grain shipments to production has been computed to get a proxy of the percentage of production that is shipped by rail in a given year. This extraction ratio has been used for Stafford County for wheat and corn.
- Futures hedges: that provide favorable or positive outcomes to the net cash price have not been included in pro-forma income statement given that is considered an externality to the net cash price. In other words, agricultural producers, traders and manufacturers only engage in futures market positions to hedge, not to speculate. Consequently, no scenarios have been included in which hedges might have resulted in favorable or unfavorable net cash prices.

Chapter 9-Appendix

Figure 7 Wheat Production Map by County

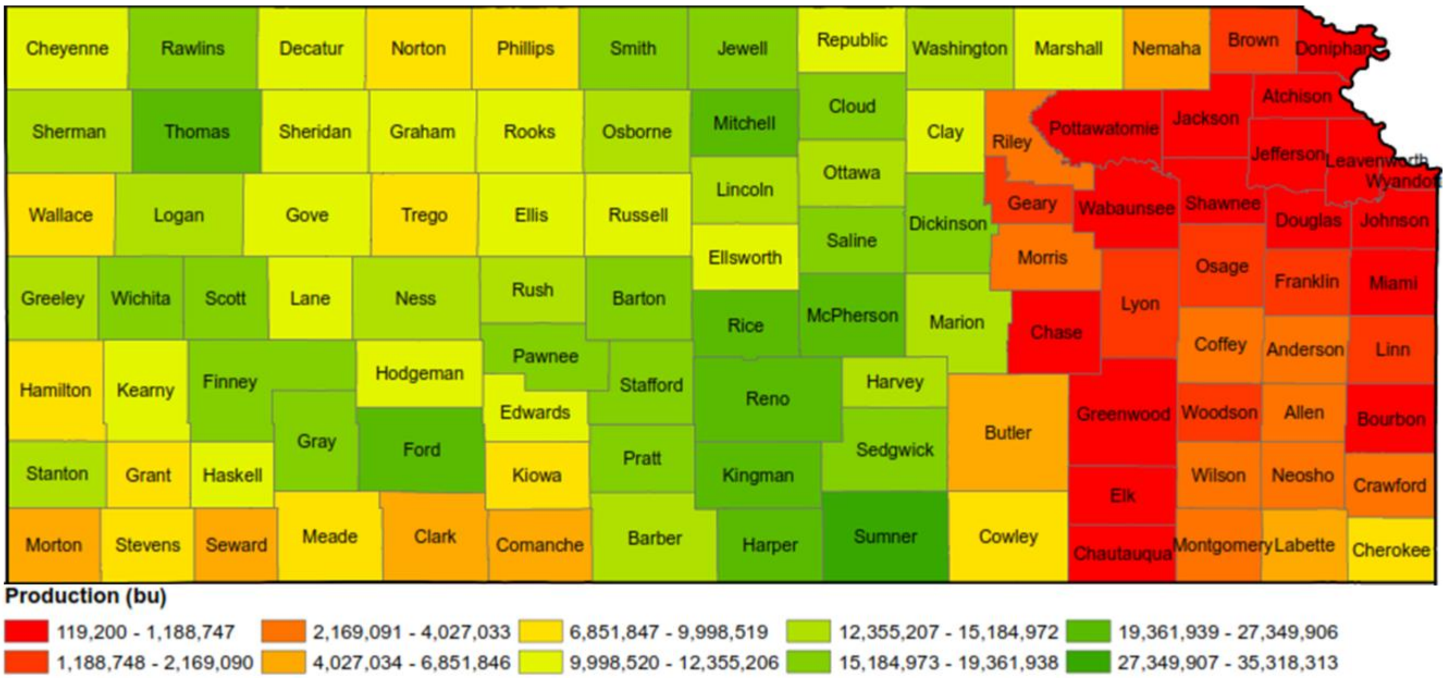


Figure 8 Corn Production Map by County

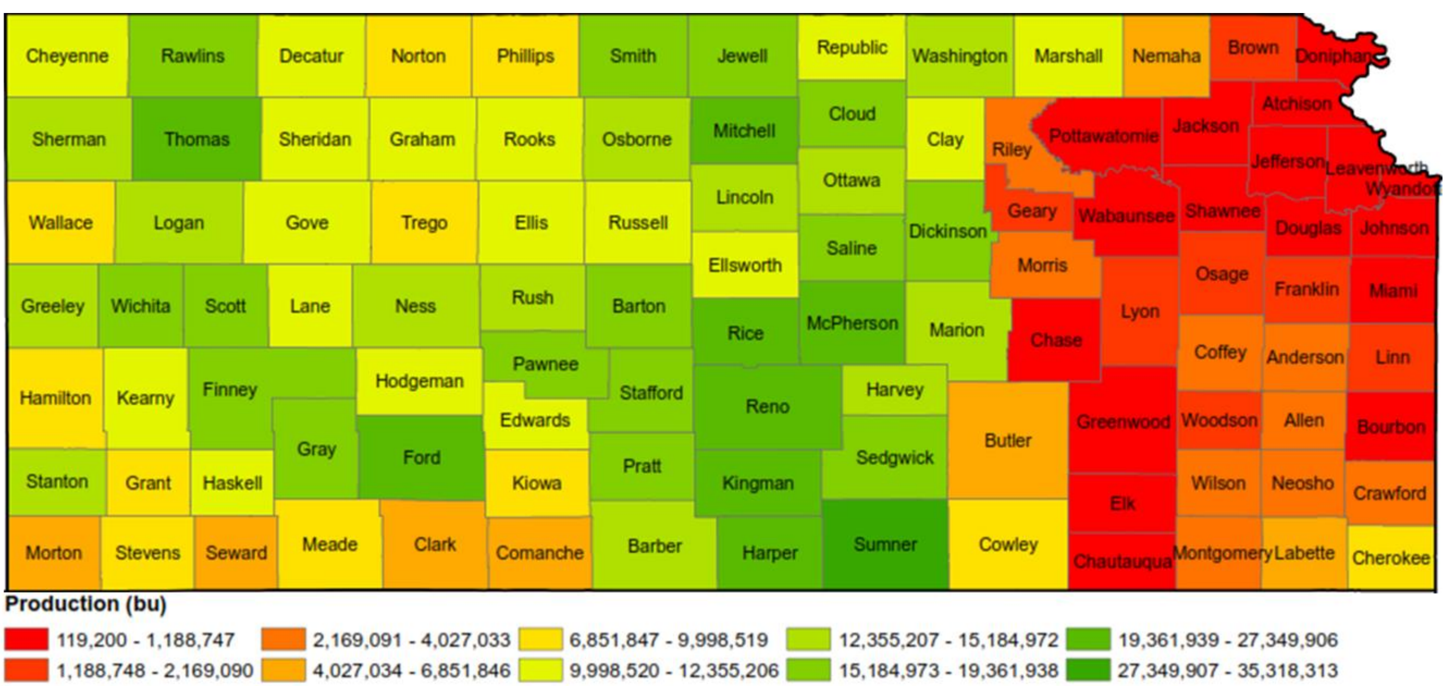


Table 17 Shuttle Loader Risk Factors

Risk Factor	Risk Type	Significance
Volume traded/shipped (market share)	Value Chain	Very High
Supplier relationship	Value Chain	Very High
Commodity Prices Spread	Market	High
Transportation cost (tariff rates, surcharges & railcar bids)	Value Chain	High
Competition	Market	High
Capital Structure (Debt vs Equity financing)	Credit	High
Interest Rates	Market	Medium
Carrier (railroad) relationship	Value Chain	Medium
Management & Labor	Operational	Low
Public-Private partnership	Operational	Very Low

Table 18 Grain Handling Costs for selected Scenarios

Handling Cost	Corn	Wheat	Total
Pessimistic	$0.0560	$0.0408	$0.0968
Base	$0.0563	$0.0411	$0.0974
Optimistic	$0.0566	$0.0414	$0.0980

Table 19 Shuttle Loader Employee Salaries

Position Title	# Employees	Salary	Total Cost
Merchandising Manager	1	85,000	85,000
Operations Manager	1	80000	80,000
Logistics Supervisor	1	60,000	60,000
Elevator Operators	5	40,000	200,000
Administrative Assistant	1	40,000	40,000
Accounting	2	55,000	110,000
TOTAL	**11**		**575,000**

Table 20 Grain Fixed Costs for selected Scenarios

Fixed Costs	Cost $	Volume	Cost $/bu
Pessimistic	$ 907,500	6,569,118	$ 0.138
Base	$ 907,500	7,261,678	$ 0.125
Optimistic	$ 907,500	7,954,237	$ 0.114

Table 21 Optimistic Volume Throughput for Wheat & Corn

County	Avg Annual Shipments*	Aggregate Capacity*	Market Share %	Shuttle Thru-Put*
Reno	5,880,465	27,667,000	5%	294,023
Ford	5,061,914	14,937,000	5%	253,096
Sedgwick	4,627,472	32,889,000	5%	231,374
Stafford	4,091,809	10,114,000	60%	2,455,085
Barton	3,968,180	12,176,000	5%	198,409
Pratt	3,883,638	8,362,000	15%	582,546
Pawnee	3,862,532	7,897,000	15%	579,380
Hodgeman	2,629,921	5,000,000	15%	394,488
TOTAL	**34,005,931**	**119,042,000**		**4,988,400**

County	Avg Annual Shipments*	Aggregate Capacity*	Market Share %	Shuttle Thru-Put*
Pratt	2,969,541	8,362,000	15%	445,431
Stafford	2,833,791	10,114,000	60%	1,700,275
Ford	1,601,477	14,937,000	15%	240,222
Reno	1,507,430	27,667,000	5%	75,372
Pawnee	1,487,037	7,897,000	15%	223,056
Sedgwick	1,361,911	32,889,000	5%	68,096
Barton	969,577	12,176,000	15%	145,437
Hodgeman	453,002	5,000,000	15%	67,950
TOTAL	**13,183,768**	**119,042,000**		**2,965,837**

Table 22 Pessimistic Volume Throughput for Wheat and Corn

County	Avg Annual Shipments*	Aggregate Capacity*	Market Share %	Shuttle Thru-Put*
Pratt	2,969,541	8,362,000	15%	445,431
Stafford	2,833,791	10,114,000	40%	1,133,517
Ford	1,601,477	14,937,000	15%	240,222
Reno	1,507,430	27,667,000	5%	75,372
Pawnee	1,487,037	7,897,000	15%	223,056
Sedgwick	1,361,911	32,889,000	5%	68,096
Barton	969,577	12,176,000	15%	145,437
Hodgeman	453,002	5,000,000	15%	67,950
TOTAL	**13,183,768**	**119,042,000**		**2,399,079**

County	Avg Annual Shipments*	Aggregate Capacity*	Market Share %	Shuttle Thru-Put*
Reno	5,880,465	27,667,000	5%	294,023
Ford	5,061,914	14,937,000	5%	253,096
Sedgwick	4,627,472	32,889,000	5%	231,374
Stafford	4,091,809	10,114,000	40%	1,636,723
Barton	3,968,180	12,176,000	5%	198,409
Pratt	3,883,638	8,362,000	15%	582,546
Pawnee	3,862,532	7,897,000	15%	579,380
Hodgeman	2,629,921	5,000,000	15%	394,488
TOTAL	**34,005,931**	**119,042,000**		**4,170,039**

Figure 9 Wheat Portfolio Analysis for selected years (Gulf Market)

Wheat Gulf Portfolio 2016-17	A	B	C	D
Avg Return ($/bu)	8.2%	1.0%	1.2%	6.1%
SD ($/bu)	5.90%	3.19%	3.11%	4.95%
Sharpe Ratio	1.39	0.30	0.39	1.22
Portfolio Weight	28.24%	24.12%	20.00%	27.65%
Portfolio Return	**4.5%**			
Portfolio Variance	**0.018%**			
Portfolio Standard Deviation	**1.36%**			
Portfolio Sharpe Ratio	**3.29**			
Portfolio Value $	**$625,935.88**			
VAR 99%	**($21,882.23)**			
VAR 95%	**($16,649.51)**			
VAR 90%	**($13,973.69)**			

Wheat Gulf Portfolio 2014-15	A	B	C	D
Avg Return ($/bu)	16.0%	-2.5%	4.3%	-6.0%
SD ($/bu)	5.62%	4.83%	4.31%	4.53%
Sharpe Ratio	2.84	-0.52	0.99	-1.32
Portfolio Weight	42.37%	18.64%	38.14%	0.85%
Portfolio Return	**7.9%**			
Portfolio Variance	**0.115%**			
Portfolio Standard Deviation	**3.39%**			
Portfolio Sharpe Ratio	**2.32**			
Portfolio Value $	**$2,076,607.28**			
VAR 99%	**($181,367.82)**			
VAR 95%	**($137,997.23)**			
VAR 90%	**($115,819.09)**			

Wheat Gulf Portfolio 2013-14	A	B	C	D
Avg Return ($/bu)	3.0%	2.8%	-4.6%	3.7%
SD ($/bu)	2.29%	2.55%	5.59%	5.47%
Sharpe Ratio	1.32	1.12	-0.82	0.67
Portfolio Weight	31.41%	30.13%	12.18%	26.28%
Portfolio Return	**2.2%**			
Portfolio Variance	**0.007%**			
Portfolio Standard Deviation	**0.87%**			
Portfolio Sharpe Ratio	**2.55**			
Portfolio Value $	**$611,654.59**			
VAR 99%	**($13,640.13)**			
VAR 95%	**($10,378.36)**			
VAR 90%	**($8,710.40)**			

Wheat Gulf Portfolio 2012-13	A	B	C	D
Avg Return ($/bu)	-5.1%	13.8%	13.1%	4.4%
SD ($/bu)	14.54%	1.71%	2.81%	2.52%
Sharpe Ratio	-0.35	8.05	4.67	1.75
Portfolio Weight	10.20%	31.63%	29.08%	29.08%
Portfolio Return	**8.9%**			
Portfolio Variance	**0.009%**			
Portfolio Standard Deviation	**0.96%**			
Portfolio Sharpe Ratio	**9.26**			
Portfolio Value $	**$2,712,131.06**			
VAR 99%	**($67,418.92)**			
VAR 95%	**($51,296.98)**			
VAR 90%	**($43,052.81)**			

Wheat Gulf Portfolio 2011-12	A	B	C	D
Avg Return ($/bu)	8.2%	4.9%	-6.2%	-4.5%
SD ($/bu)	6.87%	5.77%	3.96%	3.96%
Sharpe Ratio	1.20	0.84	-1.57	-1.14
Portfolio Weight	48.60%	44.86%	2.80%	3.74%
Portfolio Return	**5.8%**			
Portfolio Variance	**0.329%**			
Portfolio Standard Deviation	**5.74%**			
Portfolio Sharpe Ratio	**1.02**			
Portfolio Value $	**$1,655,212.51**			
VAR 99%	**($244,630.77)**			
VAR 95%	**($186,132.10)**			
VAR 90%	**($156,218.00)**			

Figure 10 Wheat Portfolio Analysis for selected years (N-West)

Wheat N-West Portfolio 2016-17	A	B	C	D
Avg Return ($/bu)	10.8%	5.7%	5.8%	10.6%
SD ($/bu)	3.90%	1.58%	2.63%	3.26%
Sharpe Ratio	2.77	3.60	2.21	3.26
Portfolio Weight	24.89%	27.15%	24.43%	23.53%
Portfolio Return	**8.1%**			
Portfolio Variance	**0.020%**			
Portfolio Standard Deviation	**1.43%**			
Portfolio Sharpe Ratio	**5.71**			
Portfolio Value $	**$1,298,793.77**			
VAR 99%	**($47,724.81)**			
VAR 95%	**($36,312.33)**			
VAR 90%	**($30,476.41)**			

Wheat N-West Portfolio 2014-15	A	B	C	D
Avg Return ($/bu)	0.6%	-9.6%	-8.8%	-18.4%
SD ($/bu)	7.60%	3.62%	6.39%	4.93%
Sharpe Ratio	0.08	-2.64	-1.38	-3.74
Portfolio Weight	93.94%	0.00%	6.06%	0.00%
Portfolio Return	**0.04%**			
Portfolio Variance	**0.543%**			
Portfolio Standard Deviation	**7.37%**			
Portfolio Sharpe Ratio	**0.00**			
Portfolio Value $	**$24,115.28**			
VAR 99%	**($4,576.76)**			
VAR 95%	**($3,482.32)**			
VAR 90%	**($2,922.66)**			

Wheat N-West Portfolio 2012-13	A	B	C	D
Avg Return ($/bu)	-7.9%	11.1%	12.1%	6.9%
SD ($/bu)	12.14%	2.11%	2.88%	1.76%
Sharpe Ratio	-0.65	5.27	4.21	3.91
Portfolio Weight	9.28%	31.44%	29.38%	29.90%
Portfolio Return	**8.4%**			
Portfolio Variance	**0.023%**			
Portfolio Standard Deviation	**1.50%**			
Portfolio Sharpe Ratio	**5.58**			
Portfolio Value $	**$2,527,575.04**			
VAR 99%	**($97,907.36)**			
VAR 95%	**($74,494.71)**			
VAR 90%	**($62,522.33)**			

Wheat N-West Portfolio 2011-12	A	B	C	D
Avg Return ($/bu)	-2.9%	-6.3%	-16.6%	-10.6%
SD ($/bu)	9.02%	5.61%	4.54%	2.82%
Sharpe Ratio	-0.33	-1.13	-3.66	-3.75
Portfolio Weight	75.00%	25.00%	0.00%	0.00%
Portfolio Return	**-3.8%**			
Portfolio Variance	**0.619%**			
Portfolio Standard Deviation	**7.87%**			
Portfolio Sharpe Ratio	**-0.48**			
Portfolio Value $	**($985,068.51)**			
VAR 99%	**($199,689.53)**			
VAR 95%	**($151,937.70)**			
VAR 90%	**($127,519.14)**			

Figure 11 Corn Portfolio Analysis for selected years (Gulf Market)

Corn Gulf Portfolio 2016-17	A	B	C	D
Avg Return ($/bu)	10.8%	-0.1%	9.2%	0.1%
SD ($/bu)	6.15%	3.83%	10.48%	2.93%
Sharpe Ratio	1.76	-0.03	0.88	0.05
Portfolio Weight	32.75%	18.13%	30.41%	18.71%
Portfolio Return	**6.4%**			
Portfolio Variance	**0.105%**			
Portfolio Standard Deviation	**3.24%**			
Portfolio Sharpe Ratio	**1.96**			
Portfolio Value $	**$655,155.88**			
VAR 99%	**($54,685.86)**			
VAR 95%	**($41,608.79)**			
VAR 90%	**($34,921.65)**			

Corn Gulf Portfolio 2015-16	A	B	C	D
Avg Return (GPM$/bu)	-2.9%	-13.6%	7.6%	-12.6%
SD ($/bu)	7.44%	4.09%	22.22%	3.08%
Sharpe Ratio	-0.39	-3.32	0.34	-4.10
portfolio weight	73.53%	0.00%	26.47%	0.00%
Portfolio Return	**-0.13%**			
Portfolio Variance	**0.324%**			
Portfolio SD	**5.69%**			
Portfolio Sharpe Ratio	**-0.02**			
Portfolio Value	**$13,920.52**			
VAR 99%	**($2,039.82)**			
VAR 95%	**($1,552.04)**			
VAR 90%	**($1,302.60)**			

Corn Gulf Portfolio 2014-15	A	B	C	D
Avg Return ($/bu)	-3.5%	-13.2%	20.9%	-10.7%
SD ($/bu)	6.68%	4.43%	27.33%	3.17%
Sharpe Ratio	-0.52	-2.99	0.76	-3.39
Portfolio Weight	48.39%	0.00%	51.61%	0.00%
Portfolio Return	**9.1%**			
Portfolio Variance	**1.650%**			
Portfolio Standard Deviation	**12.85%**			
Portfolio Sharpe Ratio	**0.71**			
Portfolio Value $	**$1,267,455.33**			
VAR 99%	**($419,452.75)**			
VAR 95%	**($319,148.81)**			
VAR 90%	**($267,857.02)**			

Corn Gulf Portfolio 2013-14	A	B	C	D
Avg Return ($/bu)	-20.7%	-33.6%	-0.1%	-33.1%
SD ($/bu)	8.87%	5.29%	28.31%	3.52%
Sharpe Ratio	-2.34	-6.35	0.00	-9.43
Portfolio Weight	0.00%	0.00%	100.00%	0.00%
Portfolio Return	**-0.1%**			
Portfolio Variance	**8.016%**			
Portfolio Standard Deviation	**28.31%**			
Portfolio Sharpe Ratio	**0.00**			
Portfolio Value $	**($15,283.03)**			
VAR 99%	**($11,146.57)**			
VAR 95%	**($8,481.09)**			
VAR 90%	**($7,118.05)**			

Figure 12 Gross Profit Margin Distribution for Wheat (Gulf)

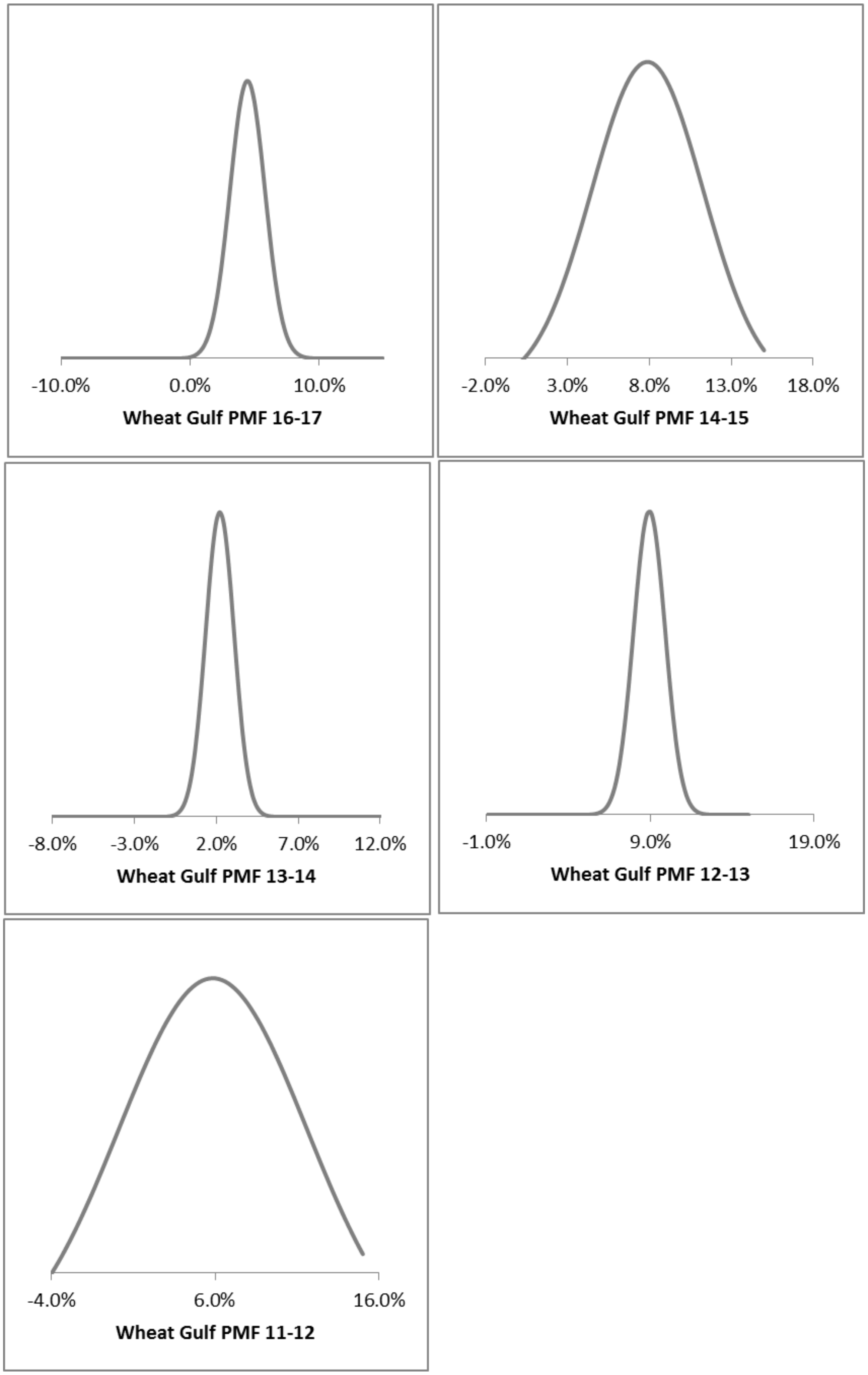


Figure 13 Net Profit Margin Distribution for Wheat (N-West)

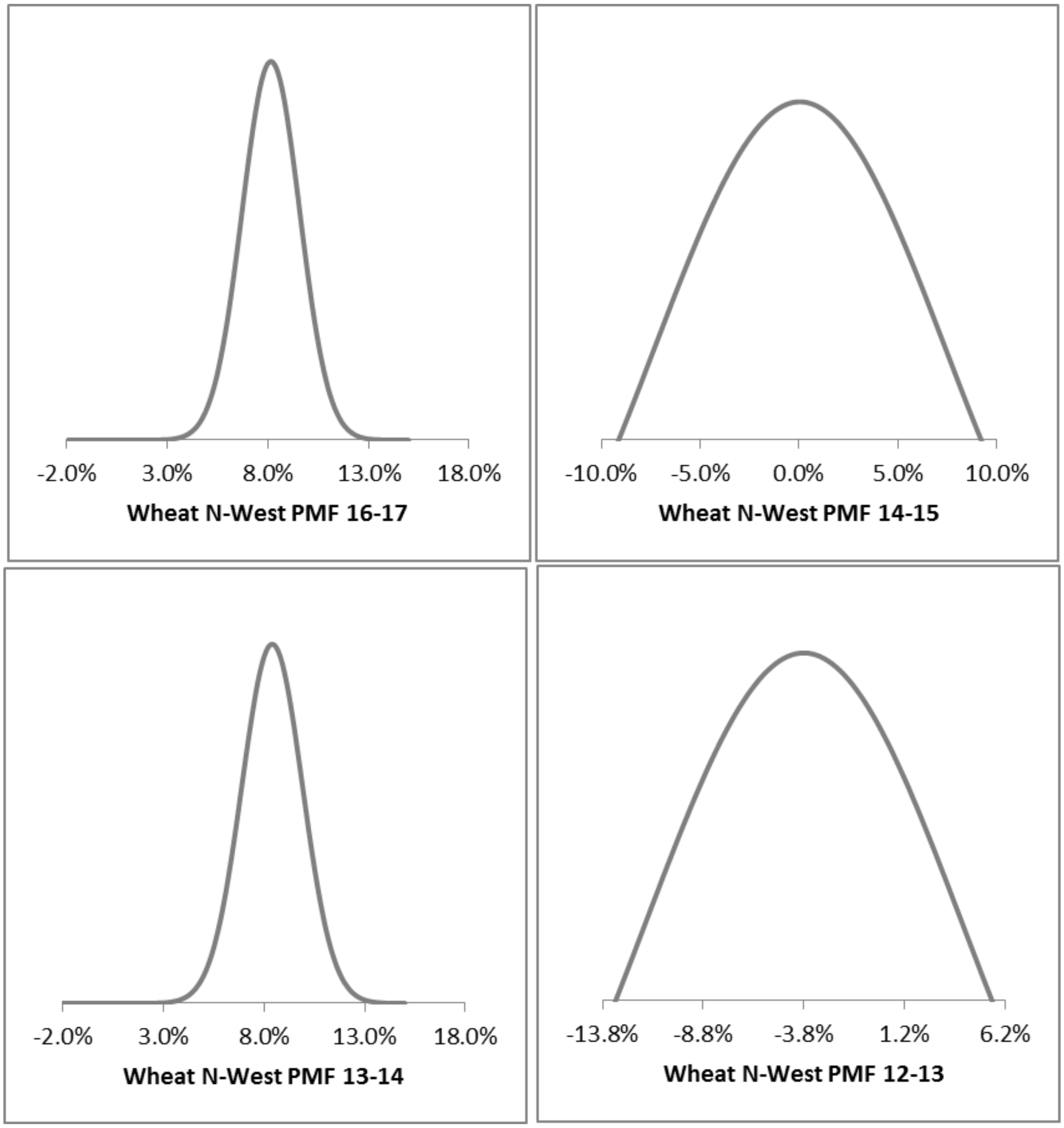


Figure 14 Net Profit Margin Distribution for Corn (Gulf)

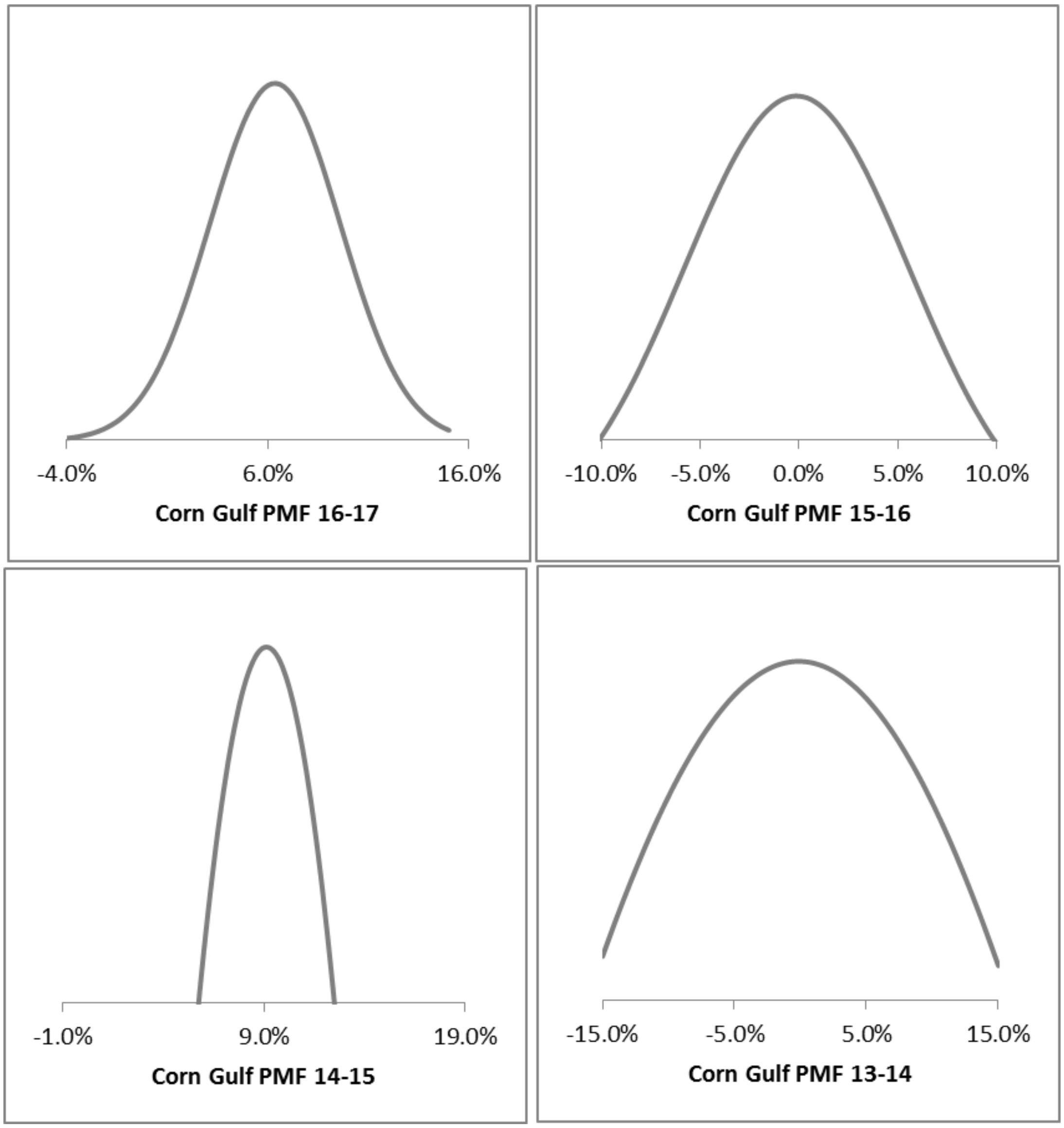


Figure 15 Sensitivity Analysis for Wheat (2016-17 & 2014-15)

Transportation Cost

A) Harvest

	3.06	3.17	3.28	3.39	3.50	3.61	3.72
1.08	0.37	0.26	0.15	0.04	0.07	0.18	0.29
1.11	0.34	0.23	0.12	0.01	0.10	0.21	0.32
1.14	0.31	0.20	0.09	0.02	0.13	0.24	0.35
1.17	0.28	0.17	0.06	0.05	0.16	0.27	0.38
1.20	0.25	0.14	0.03	0.08	0.19	0.30	0.41
1.23	0.22	0.11	0.00	0.11	0.22	0.33	0.44
1.26	0.19	0.08	0.03	0.14	0.25	0.36	0.47
1.29	0.16	0.05	0.06	0.17	0.28	0.39	0.50
1.32	0.13	0.02	0.09	0.20	0.31	0.42	0.53

B) Planting

	2.98	3.09	3.20	3.31	3.42	3.53	3.64
1.10	0.03	0.08	0.19	0.30	0.41	0.52	0.63
1.13	0.00	0.11	0.22	0.33	0.44	0.55	0.66
1.16	0.03	0.14	0.25	0.36	0.47	0.58	0.69
1.19	0.06	0.17	0.28	0.39	0.50	0.61	0.72
1.22	0.09	0.20	0.31	0.42	0.53	0.64	0.75
1.25	0.12	0.23	0.34	0.45	0.56	0.67	0.78
1.28	0.15	0.26	0.37	0.48	0.59	0.70	0.81
1.31	0.18	0.29	0.40	0.51	0.62	0.73	0.84
1.34	0.21	0.32	0.43	0.54	0.65	0.76	0.87

C) Post-Planting

	2.91	3.02	3.13	3.24	3.35	3.46	3.57
1.09	0.05	0.06	0.28	0.61	1.05	1.60	2.26
1.12	2.29	2.40	2.62	2.95	3.39	3.94	4.60
1.15	4.66	4.77	4.99	5.32	5.76	6.31	6.97
1.18	7.06	7.17	7.39	7.72	8.16	8.71	9.37
1.21	9.49	9.60	9.82	10.15	10.59	11.14	11.80
1.24	11.95	12.06	12.28	12.61	13.05	13.60	14.26
1.27	14.44	14.55	14.77	15.10	15.54	16.09	16.75
1.30	16.96	17.07	17.29	17.62	18.06	18.61	19.27
1.33	19.51	19.62	19.84	20.17	20.61	21.16	21.82

D) Pre Harvest

	2.90	3.01	3.12	3.23	3.34	3.45	3.56
1.14	0.26	0.15	0.07	0.40	0.84	1.39	2.05
1.17	2.08	2.19	2.41	2.74	3.18	3.73	4.39
1.20	4.45	4.56	4.78	5.11	5.55	6.10	6.76
1.23	6.85	6.96	7.18	7.51	7.95	8.50	9.16
1.26	9.28	9.39	9.61	9.94	10.38	10.93	11.59
1.29	11.74	11.85	12.07	12.40	12.84	13.39	14.05
1.32	14.23	14.34	14.56	14.89	15.33	15.88	16.54
1.35	16.75	16.86	17.08	17.41	17.85	18.40	19.06
1.38	19.30	19.41	19.63	19.96	20.40	20.95	21.61

Transportation Cost

A) Harvest

	5.94	6.14	6.34	6.54	6.74	6.94	7.14
1.13	1.34	1.14	0.74	0.14	0.66	1.66	2.86
1.16	2.89	3.09	3.49	4.09	4.89	5.89	7.09
1.19	7.15	7.35	7.75	8.35	9.15	10.15	11.35
1.22	11.44	11.64	12.04	12.64	13.44	14.44	15.64
1.25	15.76	15.96	16.36	16.96	17.76	18.76	19.96
1.28	20.11	20.31	20.71	21.31	22.11	23.11	24.31
1.31	24.49	24.69	25.09	25.69	26.49	27.49	28.69
1.34	28.90	29.10	29.50	30.10	30.90	31.90	33.10
1.37	33.34	33.54	33.94	34.54	35.34	36.34	37.54

B) Planting

	5.80	6.00	6.20	6.40	6.60	6.80	7.00
1.14	0.17	0.37	0.77	1.37	2.17	3.17	4.37
1.17	4.40	4.60	5.00	5.60	6.40	7.40	8.60
1.20	8.66	8.86	9.26	9.86	10.66	11.66	12.86
1.23	12.95	13.15	13.55	14.15	14.95	15.95	17.15
1.26	17.27	17.47	17.87	18.47	19.27	20.27	21.47
1.29	21.62	21.82	22.22	22.82	23.62	24.62	25.82
1.32	26.00	26.20	26.60	27.20	28.00	29.00	30.20
1.35	30.41	30.61	31.01	31.61	32.41	33.41	34.61
1.38	34.85	35.05	35.45	36.05	36.85	37.85	39.05

C) Post-Planting

	5.75	5.95	6.15	6.35	6.55	6.75	6.95
0.99	0.30	0.10	0.30	0.90	1.70	2.70	3.90
1.02	3.93	4.13	4.53	5.13	5.93	6.93	8.13
1.05	8.19	8.39	8.79	9.39	10.19	11.19	12.39
1.08	12.48	12.68	13.08	13.68	14.48	15.48	16.68
1.11	16.80	17.00	17.40	18.00	18.80	19.80	21.00
1.14	21.15	21.35	21.75	22.35	23.15	24.15	25.35
1.17	25.53	25.73	26.13	26.73	27.53	28.53	29.73
1.20	29.94	30.14	30.54	31.14	31.94	32.94	34.14
1.23	34.38	34.58	34.98	35.58	36.38	37.38	38.58

D) Pre Harvest

	5.71	5.91	6.11	6.31	6.51	6.71	6.91
0.94	0.38	0.58	0.98	1.58	2.38	3.38	4.58
0.97	4.61	4.81	5.21	5.81	6.61	7.61	8.81
1.00	8.87	9.07	9.47	10.07	10.87	11.87	13.07
1.03	13.16	13.36	13.76	14.36	15.16	16.16	17.36
1.06	17.50	17.70	18.10	18.70	19.50	20.50	21.70
1.09	21.89	22.09	22.49	23.09	23.89	24.89	26.09
1.12	26.35	26.55	26.95	27.55	28.35	29.35	30.55
1.15	30.92	31.12	31.52	32.12	32.92	33.92	35.12
1.19	35.64	35.84	36.24	36.84	37.64	38.64	39.84

Figure 16 Sensitivity Analysis for Wheat Gulf (2012-13, 2013-14)

Transportation Cost

A) Harvest

	7.13	7.38	7.63	7.88	8.13	8.38	8.63
1.08	0.26	0.01	0.49	1.24	2.24	3.49	4.99
1.11	5.02	5.27	5.77	6.52	7.52	8.77	10.27
1.14	10.33	10.58	11.08	11.83	12.83	14.08	15.58
1.17	15.67	15.92	16.42	17.17	18.17	19.42	20.92
1.20	21.04	21.29	21.79	22.54	23.54	24.79	26.29
1.23	26.44	26.69	27.19	27.94	28.94	30.19	31.69
1.26	31.87	32.12	32.62	33.37	34.37	35.62	37.12
1.29	37.33	37.58	38.08	38.83	39.83	41.08	42.58
1.32	42.82	43.07	43.57	44.32	45.32	46.57	48.07

B) Planting

	7.11	7.36	7.61	7.86	8.11	8.36	8.61
1.12	0.24	0.01	0.51	1.26	2.26	3.51	5.01
1.15	5.04	5.29	5.79	6.54	7.54	8.79	10.29
1.18	10.35	10.60	11.10	11.85	12.85	14.10	15.60
1.21	15.69	15.94	16.44	17.19	18.19	19.44	20.94
1.24	21.06	21.31	21.81	22.56	23.56	24.81	26.31
1.27	26.46	26.71	27.21	27.96	28.96	30.21	31.71
1.30	31.89	32.14	32.64	33.39	34.39	35.64	37.14
1.33	37.35	37.60	38.10	38.85	39.85	41.10	42.60
1.36	42.84	43.09	43.59	44.34	45.34	46.59	48.09

C) Post-Planting

	7.11	7.36	7.61	7.86	8.11	8.36	8.61
1.15	0.36	0.61	1.11	1.86	2.86	4.11	5.61
1.18	5.64	5.89	6.39	7.14	8.14	9.39	10.89
1.21	10.95	11.20	11.70	12.45	13.45	14.70	16.20
1.24	16.29	16.54	17.04	17.79	18.79	20.04	21.54
1.27	21.66	21.91	22.41	23.16	24.16	25.41	26.91
1.30	27.06	27.31	27.81	28.56	29.56	30.81	32.31
1.33	32.49	32.74	33.24	33.99	34.99	36.24	37.74
1.36	37.95	38.20	38.70	39.45	40.45	41.70	43.20
1.39	43.44	43.69	44.19	44.94	45.94	47.19	48.69

D) Pre Harvest

	7.05	7.30	7.55	7.80	8.05	8.30	8.55
1.20	0.31	0.06	0.44	1.19	2.19	3.44	4.94
1.23	4.97	5.22	5.72	6.47	7.47	8.72	10.22
1.26	10.28	10.53	11.03	11.78	12.78	14.03	15.53
1.30	15.64	15.89	16.39	17.14	18.14	19.39	20.89
1.34	21.06	21.31	21.81	22.56	23.56	24.81	26.31
1.38	26.54	26.79	27.29	28.04	29.04	30.29	31.79
1.42	32.11	32.36	32.86	33.61	34.61	35.86	37.36
1.47	37.81	38.06	38.56	39.31	40.31	41.56	43.06
1.51	43.68	43.93	44.43	45.18	46.18	47.43	48.93

Transportation Cost

A) Harvest

	7.41	7.66	7.91	8.16	8.41	8.66	8.91
1.01	0.41	0.66	1.16	1.91	2.91	4.16	5.66
1.04	5.69	5.94	6.44	7.19	8.19	9.44	10.94
1.07	11.00	11.25	11.75	12.50	13.50	14.75	16.25
1.10	16.34	16.59	17.09	17.84	18.84	20.09	21.59
1.13	21.71	21.96	22.46	23.21	24.21	25.46	26.96
1.16	27.11	27.36	27.86	28.61	29.61	30.86	32.36
1.19	32.54	32.79	33.29	34.04	35.04	36.29	37.79
1.22	38.00	38.25	38.75	39.50	40.50	41.75	43.25
1.25	43.49	43.74	44.24	44.99	45.99	47.24	48.74

B) Planting

	7.25	7.50	7.75	8.00	8.25	8.50	8.75
1.04	1.32	1.07	0.57	0.18	1.18	2.43	3.93
1.07	3.96	4.21	4.71	5.46	6.46	7.71	9.21
1.10	9.27	9.52	10.02	10.77	11.77	13.02	14.52
1.13	14.61	14.86	15.36	16.11	17.11	18.36	19.86
1.16	19.98	20.23	20.73	21.48	22.48	23.73	25.23
1.19	25.38	25.63	26.13	26.88	27.88	29.13	30.63
1.22	30.81	31.06	31.56	32.31	33.31	34.56	36.06
1.25	36.27	36.52	37.02	37.77	38.77	40.02	41.52
1.28	41.76	42.01	42.51	43.26	44.26	45.51	47.01

C) Post-Planting

	7.17	7.42	7.67	7.92	8.17	8.42	8.67
1.05	1.24	0.99	0.49	0.26	1.26	2.51	4.01
1.08	4.04	4.29	4.79	5.54	6.54	7.79	9.29
1.11	9.35	9.60	10.10	10.85	11.85	13.10	14.60
1.14	14.69	14.94	15.44	16.19	17.19	18.44	19.94
1.17	20.06	20.31	20.81	21.56	22.56	23.81	25.31
1.20	25.46	25.71	26.21	26.96	27.96	29.21	30.71
1.23	30.89	31.14	31.64	32.39	33.39	34.64	36.14
1.26	36.35	36.60	37.10	37.85	38.85	40.10	41.60
1.29	41.84	42.09	42.59	43.34	44.34	45.59	47.09

D) Pre Harvest

	7.06	7.31	7.56	7.81	8.06	8.31	8.56
1.05	0.37	0.12	0.38	1.13	2.13	3.38	4.88
1.08	4.91	5.16	5.66	6.41	7.41	8.66	10.16
1.11	10.22	10.47	10.97	11.72	12.72	13.97	15.47
1.14	15.57	15.82	16.32	17.07	18.07	19.32	20.82
1.18	20.97	21.22	21.72	22.47	23.47	24.72	26.22
1.21	26.43	26.68	27.18	27.93	28.93	30.18	31.68
1.25	31.97	32.22	32.72	33.47	34.47	35.72	37.22
1.29	37.62	37.87	38.37	39.12	40.12	41.37	42.87
1.33	43.43	43.68	44.18	44.93	45.93	47.18	48.68

Figure 17 Sensitivity Analysis for Corn Gulf (2016-17 & 2015-16)

Transportation Cost

A) Harvest

	3.27	3.38	3.49	3.60	3.71	3.82	3.93
1.06	0.20	0.09	0.02	0.13	0.24	0.35	0.46
1.09	0.17	0.06	0.05	0.16	0.27	0.38	0.49
1.12	0.14	0.03	0.08	0.19	0.30	0.41	0.52
1.15	0.11	0.00	0.11	0.22	0.33	0.44	0.55
1.18	0.08	0.03	0.14	0.25	0.36	0.47	0.58
1.21	0.05	0.06	0.17	0.28	0.39	0.50	0.61
1.24	0.02	0.09	0.20	0.31	0.42	0.53	0.64
1.27	0.01	0.12	0.23	0.34	0.45	0.56	0.67
1.30	0.04	0.15	0.26	0.37	0.48	0.59	0.70

B) Planting

	3.19	3.30	3.41	3.52	3.63	3.74	3.85
1.12	0.25	0.36	0.47	0.58	0.69	0.80	0.91
1.15	0.28	0.39	0.50	0.61	0.72	0.83	0.94
1.18	0.31	0.42	0.53	0.64	0.75	0.86	0.97
1.21	0.34	0.45	0.56	0.67	0.78	0.89	1.00
1.24	0.37	0.48	0.59	0.70	0.81	0.92	1.03
1.27	0.40	0.51	0.62	0.73	0.84	0.95	1.06
1.30	0.43	0.54	0.65	0.76	0.87	0.98	1.09
1.33	0.46	0.57	0.68	0.79	0.90	1.01	1.12
1.36	0.49	0.60	0.71	0.82	0.93	1.04	1.15

C) Pre-Harvest

	2.91	3.02	3.13	3.24	3.35	3.46	3.57
1.14	0.41	0.30	0.08	0.25	0.69	1.24	1.90
1.17	1.93	2.04	2.26	2.59	3.03	3.58	4.24
1.20	4.27	4.38	4.60	4.93	5.37	5.92	6.58
1.23	6.61	6.72	6.94	7.27	7.71	8.26	8.92
1.26	8.95	9.06	9.28	9.61	10.05	10.60	11.26
1.29	11.29	11.40	11.62	11.95	12.39	12.94	13.60
1.32	13.63	13.74	13.96	14.29	14.73	15.28	15.94
1.35	15.97	16.08	16.30	16.63	17.07	17.62	18.28
1.38	18.31	18.42	18.64	18.97	19.41	19.96	20.62

D) Pre-Planting

	3.23	3.34	3.45	3.56	3.67	3.78	3.89
1.15	0.27	0.38	0.49	0.60	0.71	0.82	0.93
1.18	0.30	0.41	0.52	0.63	0.74	0.85	0.96
1.21	0.33	0.44	0.55	0.66	0.77	0.88	0.99
1.24	0.36	0.47	0.58	0.69	0.80	0.91	1.02
1.27	0.39	0.50	0.61	0.72	0.83	0.94	1.05
1.30	0.42	0.53	0.64	0.75	0.86	0.97	1.08
1.33	0.45	0.56	0.67	0.78	0.89	1.00	1.11
1.36	0.48	0.59	0.70	0.81	0.92	1.03	1.14
1.39	0.51	0.62	0.73	0.84	0.95	1.06	1.17

Transportation Cost

A) Harvest

	3.27	3.38	3.49	3.60	3.71	3.82	3.93
1.06	0.18	0.07	0.04	0.15	0.26	0.37	0.48
1.09	0.15	0.04	0.07	0.18	0.29	0.40	0.51
1.12	0.12	0.01	0.10	0.21	0.32	0.43	0.54
1.15	0.09	0.02	0.13	0.24	0.35	0.46	0.57
1.18	0.06	0.05	0.16	0.27	0.38	0.49	0.60
1.21	0.03	0.08	0.19	0.30	0.41	0.52	0.63
1.24	0.00	0.11	0.22	0.33	0.44	0.55	0.66
1.27	0.03	0.14	0.25	0.36	0.47	0.58	0.69
1.30	0.06	0.17	0.28	0.39	0.50	0.61	0.72

B) Planting

	3.19	3.30	3.41	3.52	3.63	3.74	3.85
1.12	0.25	0.36	0.47	0.58	0.69	0.80	0.91
1.15	0.28	0.39	0.50	0.61	0.72	0.83	0.94
1.18	0.31	0.42	0.53	0.64	0.75	0.86	0.97
1.21	0.34	0.45	0.56	0.67	0.78	0.89	1.00
1.24	0.37	0.48	0.59	0.70	0.81	0.92	1.03
1.27	0.40	0.51	0.62	0.73	0.84	0.95	1.06
1.30	0.43	0.54	0.65	0.76	0.87	0.98	1.09
1.33	0.46	0.57	0.68	0.79	0.90	1.01	1.12
1.36	0.49	0.60	0.71	0.82	0.93	1.04	1.15

C) Pre-Harvest

	3.61	3.72	3.83	3.94	4.05	4.16	4.27
1.14	0.35	0.24	0.02	0.31	0.75	1.30	1.96
1.17	1.99	2.10	2.32	2.65	3.09	3.64	4.30
1.20	4.33	4.44	4.66	4.99	5.43	5.98	6.64
1.23	6.67	6.78	7.00	7.33	7.77	8.32	8.98
1.26	9.01	9.12	9.34	9.67	10.11	10.66	11.32
1.29	11.35	11.46	11.68	12.01	12.45	13.00	13.66
1.32	13.69	13.80	14.02	14.35	14.79	15.34	16.00
1.35	16.03	16.14	16.36	16.69	17.13	17.68	18.34
1.38	18.37	18.48	18.70	19.03	19.47	20.02	20.68

D) Pre-Planting

	3.23	3.34	3.45	3.56	3.67	3.78	3.89
1.15	0.27	0.38	0.49	0.60	0.71	0.82	0.93
1.18	0.30	0.41	0.52	0.63	0.74	0.85	0.96
1.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99
1.25	0.37	0.48	0.59	0.70	0.81	0.92	1.03
1.29	0.41	0.52	0.63	0.74	0.85	0.96	1.07
1.33	0.45	0.56	0.67	0.78	0.89	1.00	1.11
1.37	0.49	0.60	0.71	0.82	0.93	1.04	1.15
1.41	0.53	0.64	0.75	0.86	0.97	1.08	1.19
1.45	0.57	0.68	0.79	0.90	1.01	1.12	1.23

Figure 18 Sensitivity Analysis for Corn Gulf (2014-15 & 2013-14)

A) Harvest

Transportation Cost	3.27	3.38	3.49	3.60	3.71	3.82	3.93
1.06	0.19	0.08	0.03	0.14	0.25	0.36	0.47
1.09	0.16	0.05	0.06	0.17	0.28	0.39	0.50
1.12	0.13	0.02	0.09	0.20	0.31	0.42	0.53
1.15	0.10	0.01	0.12	0.23	0.34	0.45	0.56
1.18	0.07	0.04	0.15	0.26	0.37	0.48	0.59
1.21	0.04	0.07	0.18	0.29	0.40	0.51	0.62
1.24	0.01	0.10	0.21	0.32	0.43	0.54	0.65
1.27	0.02	0.13	0.24	0.35	0.46	0.57	0.68
1.30	0.05	0.16	0.27	0.38	0.49	0.60	0.71

B) Planting

Transportation Cost	3.19	3.30	3.41	3.52	3.63	3.74	3.85
1.12	0.25	0.36	0.47	0.58	0.69	0.80	0.91
1.15	0.28	0.39	0.50	0.61	0.72	0.83	0.94
1.18	0.31	0.42	0.53	0.64	0.75	0.86	0.97
1.21	0.34	0.45	0.56	0.67	0.78	0.89	1.00
1.24	0.37	0.48	0.59	0.70	0.81	0.92	1.03
1.27	0.40	0.51	0.62	0.73	0.84	0.95	1.06
1.30	0.43	0.54	0.65	0.76	0.87	0.98	1.09
1.33	0.46	0.57	0.68	0.79	0.90	1.01	1.12
1.36	0.49	0.60	0.71	0.82	0.93	1.04	1.15

C) Pre-Harvest

Transportation Cost	3.54	3.65	3.76	3.87	3.98	4.09	4.20
1.14	1.15	1.04	0.82	0.49	0.05	0.50	1.16
1.17	1.19	1.30	1.52	1.85	2.29	2.84	3.50
1.20	3.53	3.64	3.86	4.19	4.63	5.18	5.84
1.23	5.87	5.98	6.20	6.53	6.97	7.52	8.18
1.26	8.21	8.32	8.54	8.87	9.31	9.86	10.52
1.29	10.55	10.66	10.88	11.21	11.65	12.20	12.86
1.32	12.89	13.00	13.22	13.55	13.99	14.54	15.20
1.35	15.23	15.34	15.56	15.89	16.33	16.88	17.54
1.38	17.57	17.68	17.90	18.23	18.67	19.22	19.88

D) Pre-Planting

Transportation Cost	3.23	3.34	3.45	3.56	3.67	3.78	3.89
1.15	0.27	0.38	0.49	0.60	0.71	0.82	0.93
1.18	0.30	0.41	0.52	0.63	0.74	0.85	0.96
1.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99
1.25	0.37	0.48	0.59	0.70	0.81	0.92	1.03
1.29	0.41	0.52	0.63	0.74	0.85	0.96	1.07
1.33	0.45	0.56	0.67	0.78	0.89	1.00	1.11
1.37	0.49	0.60	0.71	0.82	0.93	1.04	1.15
1.41	0.53	0.64	0.75	0.86	0.97	1.08	1.19
1.45	0.57	0.68	0.79	0.90	1.01	1.12	1.23

A) Harvest

Transportation Cost	3.27	3.38	3.49	3.60	3.71	3.82	3.93
1.06	0.18	0.07	0.04	0.15	0.26	0.37	0.48
1.09	0.15	0.04	0.07	0.18	0.29	0.40	0.51
1.12	0.12	0.01	0.10	0.21	0.32	0.43	0.54
1.15	0.09	0.02	0.13	0.24	0.35	0.46	0.57
1.18	0.06	0.05	0.16	0.27	0.38	0.49	0.60
1.21	0.03	0.08	0.19	0.30	0.41	0.52	0.63
1.24	0.00	0.11	0.22	0.33	0.44	0.55	0.66
1.27	0.03	0.14	0.25	0.36	0.47	0.58	0.69
1.30	0.06	0.17	0.28	0.39	0.50	0.61	0.72

B) Planting

Transportation Cost	3.19	3.30	3.41	3.52	3.63	3.74	3.85
1.12	0.26	0.37	0.48	0.59	0.70	0.81	0.92
1.15	0.29	0.40	0.51	0.62	0.73	0.84	0.95
1.18	0.32	0.43	0.54	0.65	0.76	0.87	0.98
1.21	0.35	0.46	0.57	0.68	0.79	0.90	1.01
1.24	0.38	0.49	0.60	0.71	0.82	0.93	1.04
1.27	0.41	0.52	0.63	0.74	0.85	0.96	1.07
1.30	0.44	0.55	0.66	0.77	0.88	0.99	1.10
1.33	0.47	0.58	0.69	0.80	0.91	1.02	1.13
1.36	0.50	0.61	0.72	0.83	0.94	1.05	1.16

C) Pre-Harvest

Transportation Cost	4.30	4.41	4.52	4.63	4.74	4.85	4.96
1.14	0.01	0.10	0.32	0.65	1.09	1.64	2.30
1.17	2.33	2.44	2.66	2.99	3.43	3.98	4.64
1.20	4.67	4.78	5.00	5.33	5.77	6.32	6.98
1.23	7.01	7.12	7.34	7.67	8.11	8.66	9.32
1.26	9.35	9.46	9.68	10.01	10.45	11.00	11.66
1.29	11.69	11.80	12.02	12.35	12.79	13.34	14.00
1.32	14.03	14.14	14.36	14.69	15.13	15.68	16.34
1.35	16.37	16.48	16.70	17.03	17.47	18.02	18.68
1.38	18.71	18.82	19.04	19.37	19.81	20.36	21.02

D) Pre-Planting

Transportation Cost	3.23	3.34	3.45	3.56	3.67	3.78	3.89
1.15	0.27	0.38	0.49	0.60	0.71	0.82	0.93
1.18	0.30	0.41	0.52	0.63	0.74	0.85	0.96
1.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99
1.25	0.37	0.48	0.59	0.70	0.81	0.92	1.03
1.29	0.41	0.52	0.63	0.74	0.85	0.96	1.07
1.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10
1.37	0.48	0.59	0.70	0.81	0.92	1.03	1.14
1.41	0.53	0.64	0.75	0.86	0.97	1.08	1.19
1.45	0.57	0.68	0.79	0.90	1.01	1.12	1.23

Figure 19 Sensitivity Analysis for Wheat Gulf (2011-12)

Transportation Cost

A) Harvest

	7.29	7.54	7.79	8.04	8.29	8.54	8.79
0.91	0.74	0.49	0.01	0.76	1.76	3.01	4.51
0.94	4.54	4.79	5.29	6.04	7.04	8.29	9.79
0.96	9.84	10.09	10.59	11.34	12.34	13.59	15.09
0.99	15.16	15.41	15.91	16.66	17.66	18.91	20.41
1.01	20.51	20.76	21.26	22.01	23.01	24.26	25.76
1.04	25.89	26.14	26.64	27.39	28.39	29.64	31.14
1.06	31.29	31.54	32.04	32.79	33.79	35.04	36.54
1.09	36.71	36.96	37.46	38.21	39.21	40.46	41.96
1.11	42.16	42.41	42.91	43.66	44.66	45.91	47.41

B) Planting

	7.14	7.39	7.64	7.89	8.14	8.39	8.64
0.91	0.41	0.16	0.34	1.09	2.09	3.34	4.84
0.93	4.86	5.11	5.61	6.36	7.36	8.61	10.11
0.96	10.16	10.41	10.91	11.66	12.66	13.91	15.41
0.98	15.49	15.74	16.24	16.99	17.99	19.24	20.74
1.01	20.84	21.09	21.59	22.34	23.34	24.59	26.09
1.03	26.21	26.46	26.96	27.71	28.71	29.96	31.46
1.06	31.61	31.86	32.36	33.11	34.11	35.36	36.86
1.08	37.04	37.29	37.79	38.54	39.54	40.79	42.29
1.11	42.49	42.74	43.24	43.99	44.99	46.24	47.74

C) Post-Planting

	7.01	7.26	7.51	7.76	8.01	8.26	8.51
0.91	0.46	0.71	1.21	1.96	2.96	4.21	5.71
0.93	5.74	5.99	6.49	7.24	8.24	9.49	10.99
0.96	11.04	11.29	11.79	12.54	13.54	14.79	16.29
0.98	16.36	16.61	17.11	17.86	18.86	20.11	21.61
1.01	21.71	21.96	22.46	23.21	24.21	25.46	26.96
1.03	27.09	27.34	27.84	28.59	29.59	30.84	32.34
1.06	32.49	32.74	33.24	33.99	34.99	36.24	37.74
1.08	37.91	38.16	38.66	39.41	40.41	41.66	43.16
1.11	43.36	43.61	44.11	44.86	45.86	47.11	48.61

D) Pre Harvest

	6.93	7.18	7.43	7.68	7.93	8.18	8.43
0.93	0.34	0.59	1.09	1.84	2.84	4.09	5.59
0.96	5.62	5.87	6.37	7.12	8.12	9.37	10.87
0.98	10.91	11.16	11.66	12.41	13.41	14.66	16.16
1.00	16.24	16.49	16.99	17.74	18.74	19.99	21.49
1.03	21.60	21.85	22.35	23.10	24.10	25.35	26.85
1.06	27.00	27.25	27.75	28.50	29.50	30.75	32.25
1.08	32.46	32.71	33.21	33.96	34.96	36.21	37.71
1.11	37.98	38.23	38.73	39.48	40.48	41.73	43.23
1.14	43.61	43.86	44.36	45.11	46.11	47.36	48.86

Figure 20 Sensitivity Analysis for Wheat N-West (2016-17 & 2014-15)

Transportation Cost

	A) Harvest								B) Planting						
	3.06	3.19	3.32	3.45	3.58	3.71	3.84		2.98	3.11	3.24	3.37	3.50	3.63	3.76
1.08	1.00	0.87	0.74	0.61	0.48	0.35	0.22	1.10	0.74	0.61	0.48	0.35	0.22	0.09	0.04
1.11	0.97	0.84	0.71	0.58	0.45	0.32	0.19	1.13	0.71	0.58	0.45	0.32	0.19	0.06	0.07
1.14	0.94	0.81	0.68	0.55	0.42	0.29	0.16	1.16	0.68	0.55	0.42	0.29	0.16	0.03	0.10
1.17	0.91	0.78	0.65	0.52	0.39	0.26	0.13	1.19	0.65	0.52	0.39	0.26	0.13	0.00	0.13
1.20	0.88	0.75	0.62	0.49	0.36	0.23	0.10	1.22	0.62	0.49	0.36	0.23	0.10	0.03	0.16
1.23	0.85	0.72	0.59	0.46	0.33	0.20	0.07	1.25	0.59	0.46	0.33	0.20	0.07	0.06	0.19
1.26	0.82	0.69	0.56	0.43	0.30	0.17	0.04	1.28	0.56	0.43	0.30	0.17	0.04	0.09	0.22
1.29	0.79	0.66	0.53	0.40	0.27	0.14	0.01	1.31	0.53	0.40	0.27	0.14	0.01	0.12	0.25
1.32	0.76	0.63	0.50	0.37	0.24	0.11	0.02	1.34	0.50	0.37	0.24	0.11	0.02	0.15	0.28

	C) Post-Planting								D) Pre Harvest						
	2.91	3.04	3.17	3.30	3.43	3.56	3.69		2.90	3.03	3.16	3.29	3.42	3.55	3.68
1.58	0.28	0.15	0.11	0.50	1.02	1.67	2.45	1.60	0.54	0.41	0.15	0.24	0.76	1.41	2.19
1.61	2.48	2.61	2.87	3.26	3.78	4.43	5.21	1.63	2.22	2.35	2.61	3.00	3.52	4.17	4.95
1.64	5.27	5.40	5.66	6.05	6.57	7.22	8.00	1.68	5.03	5.16	5.42	5.81	6.33	6.98	7.76
1.67	8.09	8.22	8.48	8.87	9.39	10.04	10.82	1.73	7.90	8.03	8.29	8.68	9.20	9.85	10.63
1.70	10.94	11.07	11.33	11.72	12.24	12.89	13.67	1.78	10.84	10.97	11.23	11.62	12.14	12.79	13.57
1.73	13.82	13.95	14.21	14.60	15.12	15.77	16.55	1.84	13.86	13.99	14.25	14.64	15.16	15.81	16.59
1.76	16.73	16.86	17.12	17.51	18.03	18.68	19.46	1.89	17.00	17.13	17.39	17.78	18.30	18.95	19.73
1.79	19.67	19.80	20.06	20.45	20.97	21.62	22.40	1.95	20.30	20.43	20.69	21.08	21.60	22.25	23.03
1.82	22.64	22.77	23.03	23.42	23.94	24.59	25.37	2.01	23.83	23.96	24.22	24.61	25.13	25.78	26.56

Transportation Cost

	A) Harvest								B) Planting						
	6.29	6.49	6.69	6.89	7.09	7.29	7.49		6.22	6.42	6.62	6.82	7.02	7.22	7.42
1.62	0.05	0.15	0.55	1.15	1.95	2.95	4.15	1.72	0.69	0.89	1.29	1.89	2.69	3.69	4.89
1.66	4.19	4.39	4.79	5.39	6.19	7.19	8.39	1.76	4.93	5.13	5.53	6.13	6.93	7.93	9.13
1.70	8.47	8.67	9.07	9.67	10.47	11.47	12.67	1.80	9.21	9.41	9.81	10.41	11.21	12.21	13.41
1.74	12.79	12.99	13.39	13.99	14.79	15.79	16.99	1.84	13.53	13.73	14.13	14.73	15.53	16.53	17.73
1.78	17.15	17.35	17.75	18.35	19.15	20.15	21.35	1.88	17.89	18.09	18.49	19.09	19.89	20.89	22.09
1.82	21.55	21.75	22.15	22.75	23.55	24.55	25.75	1.92	22.29	22.49	22.89	23.49	24.29	25.29	26.49
1.86	25.99	26.19	26.59	27.19	27.99	28.99	30.19	1.96	26.73	26.93	27.33	27.93	28.73	29.73	30.93
1.90	30.47	30.67	31.07	31.67	32.47	33.47	34.67	2.00	31.21	31.41	31.81	32.41	33.21	34.21	35.41
1.94	34.99	35.19	35.59	36.19	36.99	37.99	39.19	2.04	35.73	35.93	36.33	36.93	37.73	38.73	39.93

	C) Post-Planting								D) Pre Harvest						
	6.15	6.35	6.55	6.75	6.95	7.15	7.35		6.14	6.34	6.54	6.74	6.94	7.14	7.34
1.56	0.63	0.83	1.23	1.83	2.63	3.63	4.83	1.51	1.19	1.39	1.79	2.39	3.19	4.19	5.39
1.60	4.87	5.07	5.47	6.07	6.87	7.87	9.07	1.55	5.43	5.63	6.03	6.63	7.43	8.43	9.63
1.64	9.15	9.35	9.75	10.35	11.15	12.15	13.35	1.61	9.73	9.93	10.33	10.93	11.73	12.73	13.93
1.68	13.35	13.67	14.07	14.67	15.47	16.47	17.67	1.67	14.11	14.31	14.71	15.31	16.11	17.11	18.31
1.72	17.83	18.03	18.43	19.03	19.83	20.83	22.03	1.74	18.58	18.78	19.18	19.78	20.58	21.58	22.78
1.76	22.23	22.43	22.83	23.43	24.23	25.23	26.43	1.81	23.19	23.39	23.79	24.39	25.19	26.19	27.39
1.80	26.67	26.87	27.27	27.87	28.67	29.67	30.87	1.88	27.98	28.18	28.58	29.18	29.98	30.98	32.18
1.84	31.15	31.35	31.75	32.35	33.15	34.15	35.35	1.96	33.05	33.25	33.65	34.25	35.05	36.05	37.25
1.88	35.67	35.87	36.27	36.87	37.67	38.67	39.87	2.04	38.56	38.76	39.16	39.76	40.56	41.56	42.76

Figure 21 Sensitivity Analysis for Wheat N-West (2012-13 & 2011-12)

Transportation Cost

A) Harvest

	6.96	7.18	7.40	7.62	7.84	8.06	8.28
1.46	0.61	0.83	1.27	1.93	2.81	3.91	5.23
1.50	5.27	5.49	5.93	6.59	7.47	8.57	9.89
1.54	9.97	10.19	10.63	11.29	12.17	13.27	14.59
1.58	14.71	14.93	15.37	16.03	16.91	18.01	19.33
1.62	19.49	19.71	20.15	20.81	21.69	22.79	24.11
1.66	24.31	24.53	24.97	25.63	26.51	27.61	28.93
1.70	29.17	29.39	29.83	30.49	31.37	32.47	33.79
1.74	34.07	34.29	34.73	35.39	36.27	37.37	38.69
1.78	39.01	39.23	39.67	40.33	41.21	42.31	43.63

B) Planting

	6.91	7.13	7.35	7.57	7.79	8.01	8.23
1.46	1.05	0.83	0.39	0.27	1.15	2.25	3.57
1.50	3.61	3.83	4.27	4.93	5.81	6.91	8.23
1.54	8.31	8.53	8.97	9.63	10.51	11.61	12.93
1.58	13.05	13.27	13.71	14.37	15.25	16.35	17.67
1.62	17.83	18.05	18.49	19.15	20.03	21.13	22.45
1.66	22.65	22.87	23.31	23.97	24.85	25.95	27.27
1.70	27.51	27.73	28.17	28.83	29.71	30.81	32.13
1.74	32.41	32.63	33.07	33.73	34.61	35.71	37.03
1.78	37.35	37.57	38.01	38.67	39.55	40.65	41.97

C) Post-Planting

	6.82	7.04	7.26	7.48	7.70	7.92	8.14
1.47	1.14	0.92	0.48	0.18	1.06	2.16	3.48
1.51	3.52	3.74	4.18	4.84	5.72	6.82	8.14
1.55	8.22	8.44	8.88	9.54	10.42	11.52	12.84
1.59	12.96	13.18	13.62	14.28	15.16	16.26	17.58
1.63	17.74	17.96	18.40	19.06	19.94	21.04	22.36
1.67	22.56	22.78	23.22	23.88	24.76	25.86	27.18
1.71	27.42	27.64	28.08	28.74	29.62	30.72	32.04
1.75	32.32	32.54	32.98	33.64	34.52	35.62	36.94
1.79	37.26	37.48	37.92	38.58	39.46	40.56	41.88

D) Pre Harvest

	6.68	6.90	7.12	7.34	7.56	7.78	8.00
1.48	0.60	0.38	0.06	0.72	1.60	2.70	4.02
1.52	4.06	4.28	4.72	5.38	6.26	7.36	8.68
1.58	8.78	9.00	9.44	10.10	10.98	12.08	13.40
1.65	13.57	13.79	14.23	14.89	15.77	16.87	18.19
1.71	18.46	18.68	19.12	19.78	20.66	21.76	23.08
1.78	23.48	23.70	24.14	24.80	25.68	26.78	28.10
1.85	28.69	28.91	29.35	30.01	30.89	31.99	33.31
1.93	34.17	34.39	34.83	35.49	36.37	37.47	38.79
2.00	40.08	40.30	40.74	41.40	42.28	43.38	44.70

Transportation Cost

A) Harvest

	7.10	7.32	7.54	7.76	7.98	8.20	8.42
1.43	0.24	0.46	0.90	1.56	2.44	3.54	4.86
1.47	4.90	5.12	5.56	6.22	7.10	8.20	9.52
1.51	9.60	9.82	10.26	10.92	11.80	12.90	14.22
1.55	14.34	14.56	15.00	15.66	16.54	17.64	18.96
1.59	19.12	19.34	19.78	20.44	21.32	22.42	23.74
1.63	23.94	24.16	24.60	25.26	26.14	27.24	28.56
1.67	28.80	29.02	29.46	30.12	31.00	32.10	33.42
1.71	33.70	33.92	34.36	35.02	35.90	37.00	38.32
1.75	38.64	38.86	39.30	39.96	40.84	41.94	43.26

B) Planting

	6.95	7.17	7.39	7.61	7.83	8.05	8.27
1.43	0.50	0.72	1.16	1.82	2.70	3.80	5.12
1.47	5.16	5.38	5.82	6.48	7.36	8.46	9.78
1.51	9.86	10.08	10.52	11.18	12.06	13.16	14.48
1.55	14.60	14.82	15.26	15.92	16.80	17.90	19.22
1.59	19.38	19.60	20.04	20.70	21.58	22.68	24.00
1.63	24.20	24.42	24.86	25.52	26.40	27.50	28.82
1.67	29.06	29.28	29.72	30.38	31.26	32.36	33.68
1.71	33.96	34.18	34.62	35.28	36.16	37.26	38.58
1.75	38.90	39.12	39.56	40.22	41.10	42.20	43.52

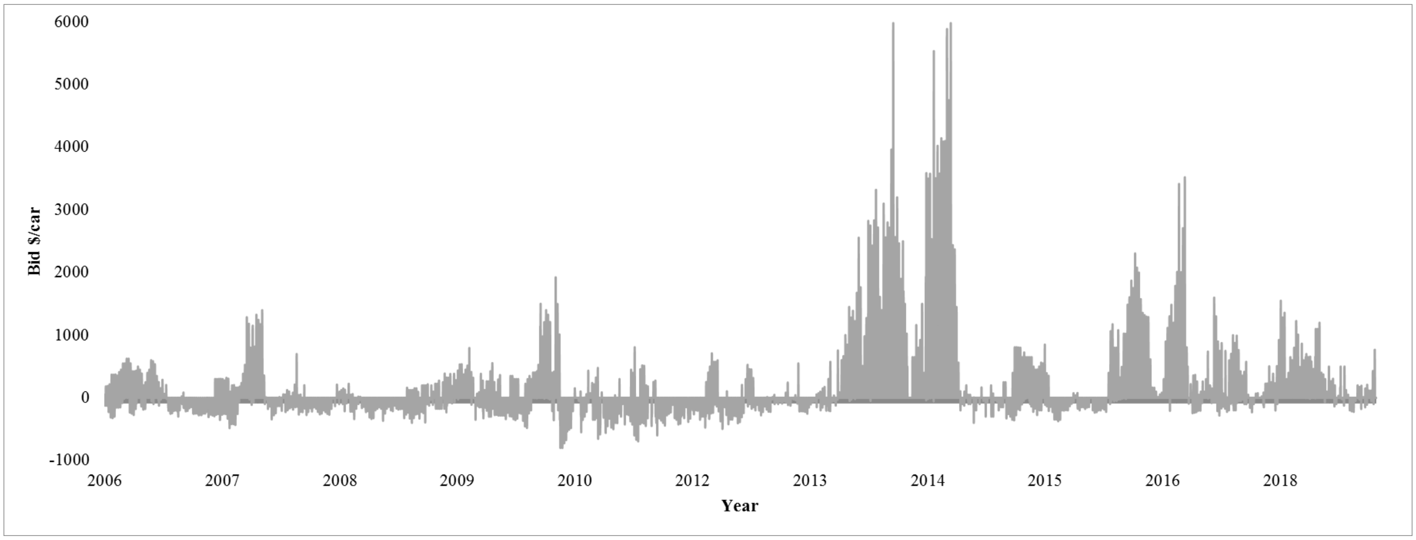
C) Post-Planting

	6.81	7.03	7.25	7.47	7.69	7.91	8.13
1.42	1.17	1.39	1.83	2.49	3.37	4.47	5.79
1.46	5.83	6.05	6.49	7.15	8.03	9.13	10.45
1.50	10.53	10.75	11.19	11.85	12.73	13.83	15.15
1.54	15.27	15.49	15.93	16.59	17.47	18.57	19.89
1.58	20.05	20.27	20.71	21.37	22.25	23.35	24.67
1.62	24.87	25.09	25.53	26.19	27.07	28.17	29.49
1.66	29.73	29.95	30.39	31.05	31.93	33.03	34.35
1.70	34.63	34.85	35.29	35.95	36.83	37.93	39.25
1.74	39.57	39.79	40.23	40.89	41.77	42.87	44.19

D) Pre Harvest

	6.72	6.94	7.16	7.38	7.60	7.82	8.04
1.42	0.78	1.00	1.44	2.10	2.98	4.08	5.40
1.46	5.44	5.66	6.10	6.76	7.64	8.74	10.06
1.52	10.16	10.38	10.82	11.48	12.36	13.46	14.78
1.58	14.95	15.17	15.61	16.27	17.15	18.25	19.57
1.65	19.83	20.05	20.49	21.15	22.03	23.13	24.45
1.71	24.84	25.06	25.50	26.16	27.04	28.14	29.46
1.78	30.02	30.24	30.68	31.34	32.22	33.32	34.64
1.85	35.47	35.69	36.13	36.79	37.67	38.77	40.09
1.92	41.34	41.56	42.00	42.66	43.54	44.64	45.96

Figure 22 Historic Shuttle RailCar Bids ($/Car)



Interviews

- What local demand for grain do you consider the most predominant?

Fertilizer imports from the port of Catoosa, Oklahoma. Company A

Local demand of corn for feed and ethanol. Company E

Local demand of corn for feed and ethanol. In addition, demand for fertilizer use is also large. Company F

- What is the average expected payback period for an investment in a shuttle loader?

For a multinational, the average expected payback period is three to four years, while for a cooperative is five to six years. Company A

For a steel bin construction, the average payback period I would consider is between 10 and 12 years. For a concrete bin, I would consider a 15 year payback. Company D

Seven years Company F

- What is the average inventory turnover for a shuttle elevator?

Turnover rate oscillates between 4 and 8 per year Company A

Turnover rate oscillates between 5 and 6 per year while for country elevators no more than 1.5 per year. Company E

- How many shuttle trains would you expect to ship every month for a two million bushel facility?

I would expect from three to four, 110 railcar train every month. Company A

I would expect from four to five, 110 railcar train every month. Company D

I would expect four to six, 110 railcar shipments per month. Company F

- How important is it to have a partnership, joint venture or strategic alliance with another party for the long term success of the company?

The potential synergies opportunities of cooperative with multinational partners could be significant and extremely important if you can manage the relationship. It is important to align expectations for both parties. One party may expect a four percent ROI, while another may expect eight percent ROI. So long as the objectives and expectations are aligned and the relationship is stable, this business structure will have long term success in the market. Company E

In the grain business, it is extremely important. Some business managers are skeptical about these types of business structures but we believe it has been an integral part of our success over time. This industry requires ears and eyes everywhere, all the time. Because of this, it is important to partner with larger industry participants that are able to boost your business outreach to levels that you could not otherwise achieve on your own. Company D

- What is the freight advantage of shuttle loaders versus country elevators?

  Roughly 10 to 15 cents per bushel. Company F

  Roughly between 8 to 10 cents per bushel Company A

  Roughly 10 cents per bushel. Company E

- What gross profit margin range would you consider for this type of investment?

  A margin range of 20 to 30 cents per bushel. Company A

  A margin range of 15 to 20 cents per bushel. Company D

- What is the average expected ROI for this investment?

  Between 5 to 13 percent. Company C

  Between 4 to 8 percent. Company E

- What mix of trade vs storage would you consider ideal for a shuttle loader?

For a shuttle loader, I would expect to be trading 90 percent of the time. Realistically, the market is not going to provide that incentive all the time, so I would expect on average to be trading 75 percent of time and storing 25 percent of the time. Company A

Depends on what the market tells you. If there is incentive to store, you store, if not you arbitrage. Nevertheless, for a shuttle loader I would expect at least 51% of the time to be trading (turning inventory) rather than storing grain. Company D

- How important are the relationships with country elevators and farmers for grain origination?

It is ideal to establish grain marketing strategies with local farmers and co-ops to meet shuttle train volume requirements in order to get the benefit of lower tariff rates from the railroad. Remember, if shipments do not reach 100 railcars or more, there is no benefit of lower rates and your competitiveness is reduced. Company A

- How important is the relationship with the shipper (i.e railroad)?

It is extremely important. Railroads have significant market power over grain companies. Because of this, it is important to partner with large multinationals that have several assets around the country not only to market your grain, but to reduce the possibility of opportunistic behavior from railroads with respect to contractual agreements for rail rates. Company A

- Would you consider investing in a shuttle loader in Stafford County?

  Given I already have assets in the area, I am not considering investing in one additional loader at this time. Company B

  I do not believe the county is grain dense enough to justify the investment. Other counties such as Reno or Sumner provide greater density values that justify the investment. Company C