A make vs buy truck logistics decision for grain companies

by

Matthew Irsik

B.A, Kansas State University, 2010

A THESIS

Submitted in partial fulfillment of the requirements

for the degree

MASTER OF AGRIBUSINESS

Department of Agricultural Economics

College of Agriculture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2017

Approved by:

Major Professor
Dr. Keith Harris

ABSTRACT

Grain companies in the United States face many different challenges operating in a mature industry with a rich history in agriculture. The purpose of this thesis project is to examine a solution for a grain companies operating in a geographical region with considerable competition. By focusing on differentiation in level of services offered to customers, grain companies can become more profitable. The results of this study offer a solution, which centers on supply chain logistics.

The objective of this project is to examine the make vs buy decision for operating a truck and trailer for grain transportation. Determining the decision factors that influence which method is the most optimal and to provide a method of relating the costs associated with each choice. In order to make an economic decision, a Truck Cost Calculator will be created to best reflect the most realistic cost structure for owning and operating a truck and trailer in house during an average crop year for a facility in Pratt County, KS. Other decision factors that are non-economic that provide a strategic benefit to a business will also be part of the project.

Using industry data and relevant variables for the cost calculator, the end result is that operating choosing to operate truck logistics in house is the most cost effective option in the make vs buy decision. The optimal choice will differ individually between businesses when a strategic approach is taken to assess whether or not logistics is a core competency in the supply chain.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

The author would like to personally dedicate this thesis to his family and colleagues that supported him throughout the program. A special thanks to his wife for the encouragement she has shown for the past few years in completing the program. To the Kansas State University Masters of Agribusiness, thank you for the support and assistance to develop such an exceptional program for professionals to further their education.

CHAPTER I: INTRODUCTION

1.1 Background and Justification

Agriculture is an industry deeply rooted in the history of our nation and even further back to the beginning of recorded history. Few civilizations have survived in the absence of agriculture to provide sustenance for the population. The modern system of food production would not be as technologically advanced if it were not for past generations of pioneers developing the land. Never in history has society produced as much from so few resources, constantly pushing the output potential that one acre of land will yield. Population growth fuels the need for agriculture to continue innovating with technology and management practices.

The United States produced 20.6 billion bushels of feed grains and wheat in the 2014/15 marketing year (USDA 2016). Of that total production number, 1.1 billion bushels of feed grains were produced in Kansas for 2015 (N. USDA 2016). Grain markets match supply with demand to create an efficient supply chain that moves grain surplus to grain deficit areas. The process of getting food to the table can be complex with many different stages of processing along the way. The supply chain for grain starts with the producer in the field planting the seed to raise a crop to be harvested at a later date. One of the more challenging areas of the production process is determining where the grain goes once it is harvested out of the field.

For grain to make it from the field to a point of storage or consumption, a truck is usually involved in the transportation process. The three modes of transportation in the US are rail, barge and truck. In 2013, 64% of all US grain was shipped by truck (Agriculture

2015). Transportation can be supplied by either the buyer or the seller of the grain commodity depending on the contract specifications. The majority of the time, the producer (seller) hauls grain directly to a grain elevator (buyer) for storage. In this respect, it would be said that the producer is "delivering" grain to the elevator. An alternative is for the producer to arrange for the grain to be "picked up" directly out of the field by the buyer. There are many pros and cons for each transportation option depending upon individual circumstances. For a grain elevator, providing transportation support to the producer by picking up grain directly from the field offers many benefits for all parties involved. Commercial grain companies with elevator storage will also trade grain between each other. The same scenario applies where the buyer or seller can be responsible for the transportation of the commodity. During the contract negotiation where commodity, price, shipment period, and other factors are agreed upon, the party responsible for hauling the grain is decided as well. So it can either be the buyer or the seller's responsibility to haul the grain from origin to destination.

For all the different stages of grain production, the logistical aspect is of extreme importance in the role it serves in the industry. Grain needs to move both at a minimal cost to the buyer/seller and at the maximum value for the commodity. In many cases, more time is spent determining the best market and how grain is transported to that market in the most cost effective manner. Grain companies employ people that solely focus on finding and contracting freight to move grain because of the complexity of logistical constraints and capacities between origins and destinations.

1.2 Industry Environment

The United States has an exceptionally well developed national infrastructure for the grain handling business. Grain production varies across the nation depending on the commodity, weather conditions, soil quality, and topography of the land. Storage and processing facilities are scattered from coast to coast largely concentrated in areas of production and export. Grain handling facilities can be categorized by ownership such as corporate, cooperative, or private. To handle the logistics of the grain trade, the US has a vast network of railroads, interstate highways, and river systems to move grain. Futures markets work as a mechanism to ration supply and demand for different commodities and provide real time market pricing. US grain producers have a national market that consists of domestic or international use via export. Domestic users of grain range anywhere from small cattle feeding operations, food ingredient manufacturers, ethanol plants, to large corporate flour milling companies that process wheat into flour for bakeries. International demand for US grain is abundant with grain moving to various places such as China, Jordan, and Niger among others. In the 2014/15 marketing year, exports as a percent of production were 42% for wheat, 14% for corn, 81% for sorghum, and 46% for soybeans (USDA 2016).

Taking a narrowed view of a local environment, Pratt County, KS is an area in central Kansas with five different grain companies operating in a 30 mile radius(See Appendix A for a map). Grain production for the area is corn, wheat, sorghum, and soybeans. The producer has different options to choose from when deciding where to take grain. The main competition for grain is between multiple cooperatives, cattle feeders, and a local ethanol plant with shuttle loading capability. Pratt County is a surplus market for

wheat, soybeans, and milo while being a deficit market for corn since an ethanol plant became operational. All wheat production is exported out of the county to the domestic milling market or the Gulf export market. Cattle feeders and the ethanol plant are the only end users in the county that are capable of adding value to the grain product which consequently makes them the most competitive bidders in the market. The local cooperatives remain competitive for what they will pay for harvest time grain and make sales throughout the course of the year to the best market.

1.3 Logistical Impact to Grain Contracts

The National Grain and Feed Association (NGFA) establishes and maintains grain trading rules for U.S agriculture. The NGFA requires that the original articles of trade shall include the applicable specifications in writing as agreed upon by the buyer and seller in the contract (Association 2015). One of the specifications is that price can be figured on a F.O.B (Freight on Board) or Delivered basis point. This part of the contract allows buyers and sellers to determine the price received from either the origin or destination points. If a contract determined the price basis to be "Delivered Wichita, KS", that would mean that the seller would receive that price for the grain if delivered to Wichita, KS. If a contract determined the price basis to be "F.O.B Hutchinson, KS", the seller would receive that price for the grain picked up in Hutchinson, KS. Table 2.1 provides an illustration of the delivery prices used by the buyer and seller to communicate the cost of grain delivered or undelivered.

Table 1.1: F.O.B vs. Delivered

Price Basis:	FOB Hutchinson, KS	Freight Cost	Delivered Wichita, KS
Cash Price Received:	$4.50	$0.15	$4.65

There is a price difference for the seller from each price basis point (Table 1.1). The origin point of the grain would be Hutchinson, KS in either on farm storage or at a grain facility. The buyer would be located in Wichita, KS, the destination of the grain. The seller has two options, to sell the grain F.O.B Hutchinson, KS and let the buyer pick it up for $4.50 per bushel, or to sell the grain delivered to Wichita, KS to the destination point of the buyer and receive $4.65. The question that the seller must answer is, "Which location basis has the best value for me?". If the seller can arrange transportation for the grain to Wichita for less than the freight cost of $0.15 per bushel, the better option is to accept the risk of delivering the grain by accepting a Delivered Wichita, KS price basis. If the seller cannot do better than $0.15 per bushel for transportation, the better option is to sell the grain at the F.O.B Hutchinson, KS basis. This simplified scenario highlights one of the most common considerations the buyer and seller must consider when agreeing to a contract.

1.4 Problem Statement

A crowded competitive environment is a problem grain companies face when trying to gain market share. The goal of doing business is to grow and remain more profitable over time. For a grain company, this is done by increasing volume and margin opportunity. It becomes difficult under the pure competition that exists for grain companies in Pratt County, KS to do this. Local grain facilities are similar in the respect they all have relatively similar services to offer, especially true for cooperatives. Price is a main driver in determining where grain is sold in most cases and traditionally a first step to trading grain by evaluating local bids. Additional factors the sellers take into account are location, distance from origin, speed, capacity, quick payment, restrictions, and other factors that an

individual may value differently. Buyers of grain also have multiple factors to account for when deciding how much to pay for grain. These factors may include available capacity, current marketing positions, available bin space, storage or processing, and grain quality among others. Elevators are willing to bid more for grain based on what value can be obtained reselling the grain. For an end user or a shuttle loading capable facility, the bid is usually a premium due to their ability to create more value on the sell side of trading. In areas as saturated with competition like central Kansas, it becomes difficult for one company to separate themselves from the rest.

1.5 Market Structure

The grain industry for Pratt County mostly resembles an oligopoly. The market has very few firms of which an action taken by one will affect the others. Price changes are the best example of an action firms take to be more competitive. Grain bids are negotiable and often well-known between firms as grain companies post bids publicly by radio, Internet, or newspaper. Grain facilities in general will have subtle differences in design or capacity that make operations more efficient but as continuous improvement occurs, capital projects even the playing field. Grain companies are offering the same services to the producer making it a very price driven industry. Geographical differentiation is inherent to the industry as facilities are put in places that are perceived as the most optimal for business. For a market with these characteristics, finding solutions to remain competitive becomes an important practice. The customer can be a great source for evaluating solutions and creating new ideas to increase market share for the territory. Increasing the quantity of services to the customer seems to be a common way grain companies try to gain market share back

from the competition. In the past several years, offering new grain marketing alternatives and different contracting options were enough, but the rest of the industry was easy to catch on and offer the same service. Producers are looking for ways to cut costs and reduce capital needs for equipment, and this is where some opportunity exists to help with that need.

1.6 Research Question

How can grain companies combat an environment of oligopoly to create better value to the customer and differentiate themselves from the competition? One solution to the problem can be found by focusing on logistics portion of the grain trading process. For grain companies that decide to offer logistical support by picking up grain from either a producer or another commercial grain company, there are a few different options in how to obtain freight. The two dominant choices are: 1) having a company owned truck and trailer operated by an employee; 2) to use contract carriers at an agreed upon rate. Finding which option is most optimal requires looking at the benefits and drawbacks of each. As grain companies look to provide value and service to the customer, being able to provide transportation options on a F.O.B basis is becoming more critical to being competitive in the market place.

1.7 Research Objective

The purpose of this project is to consider different logistical support options grain companies use to create better value to the customer and differentiate themselves among the competition. Analyzing cost data from internal and external sources as well as industry average data will provide for a comprehensive review for accurate costs. The objective is to determine which alternative is the most economic for a grain facility located in central Kansas given the current market cost data.

This project provides value for grain companies by looking at a logistical solution that has a positive economic benefit for the business. From a producer point of view, managing and owning its own transportation assets is a way in which a grain company can provide more service, create value, reduce risk, and save time. For the grain company, this can be a way to increase the radius of grain origination to gain new customers and increase grain volume handled through the facility. From a trading point of view, providing freight can increase flexibility and opportunities that would not have existed before. Quite often grain trades are missed because of a lack of available logistical capacity to execute the trade.

CHAPTER II: LITERATURE REVIEW

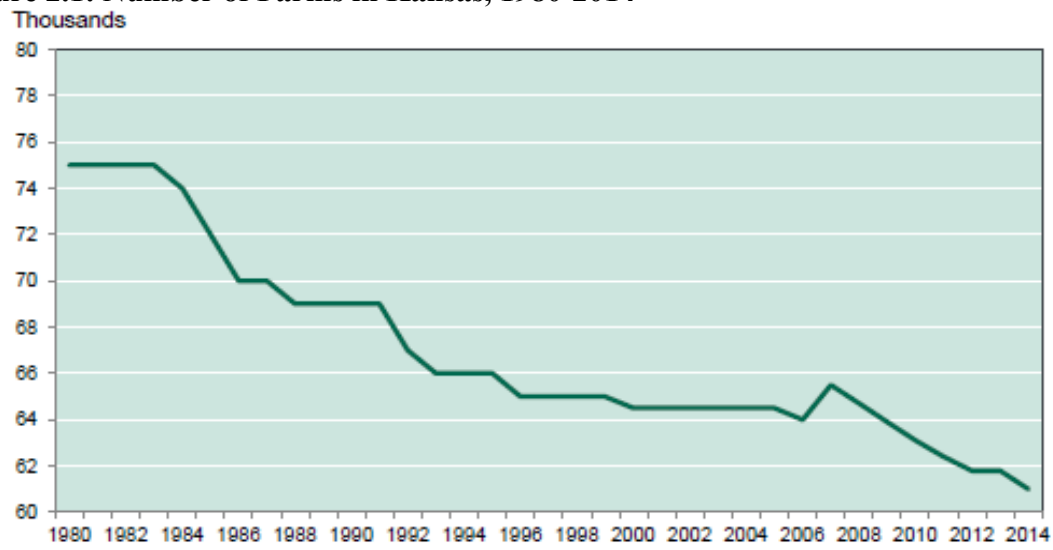
2.1 Producer Outlook

The majority of grain facilities across the United States originate grain directly from farmers otherwise known as producers. The producer origination happens mainly during harvest periods which differ depending on the commodity. It is important to know what is happening to the producer environment to be better positioned to solve their problems.

2.2.1 Average Farm Size

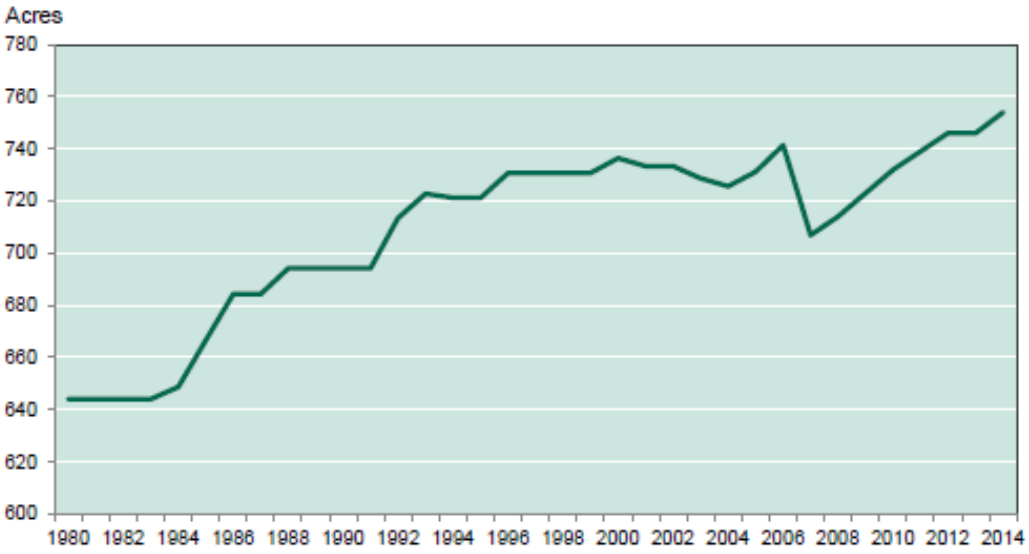
The size of a farm operation is mostly measured in acres of production to provide for a method of comparison between them. The agricultural industry has seen consolidation occur for many decades with farm operations as no exception. Many reasons exist for this consolidation such as lower grain revenues, increased input costs, equipment costs, ownership structure, land prices, and lack of next generation to continue the business. The average farm size is increasing while the number of farms is decreasing, further supporting the notion of consolidation. Demand is another driver that pushes the industry towards the path of consolidation as population growth will need increased levels of cereal grain production. By 2050, the world's population is projected to be 34% higher consuming 42% more cereal grains that it did in 2008 (FAO 2008). This additional volume of grain will need to be harvested and transported in the same amount of time as it is today. Logistics will play an important role to meeting the additional capacity requirements that world demand has placed on producers. Figures 2.1 and 2.2 show the change in number and size of farms in Kansas from 1980-2014. Substantial consolidation has occurred since 1980.

Figure 2.1: Number of Farms in Kansas, 1980-2014



Source: (N. USDA 2016)

Figure 2.2: Average Size of Farms in Kansas, 1980-2014



Source: (N. USDA 2016)

Figures 2.1 and 2.2 illustrate what is happening to farms in Kansas. This has many implications for both operators and grain companies that purchase grain from producers. As producers acquire more land they exhibit economies of scale with lower operating costs

being able to spread out equipment costs to more acres. Larger quantities of grain production per farm occur making grain marketing and risk management even more important. Lower expected cash grain prices force more consolidation and puts pressure on producers to seek further cost savings and participate in alternative practices never considered before. It is common to see equipment purchases for hauling grain be put off in favor of purchasing equipment to plant, fertilize, and harvest the crop instead.

2.2 Make vs Buy Decision

The costs of coordination within a firm and the cost of using the market are affected by a firm's ability to purchase inputs, such as transportation, raw material, or services from other firms. The ability to supply these inputs depends in part on their costs of coordinating with the market or within one's own organization. The cost of coordination is referred to as transaction costs (Coase 1960). What grain companies are dealing with is a complex interrelated structure, that is influenced by social system, laws, and technological changes technology, of the social system, and of the culture, as well as the effects of technological changes. As such, grain companies have a complicated set of interrelationships.

Baker, a dean of Harvard Business School, and Hubbard a professor at Kellogg School of Management, conducted extensive research in transportation and proposed to understand the patterns of asset ownership in the trucking industry by the use of on-board computer technology (OBC). The goal was to understand the features of OBC's and other features that move firms to or from private carriage ownership, additional framework for providing incentives to intermediaries and job design were also factors that affected

ownership patterns. Job design and load matching are two important functions for determining the logistical move taking place to determine whether making or buying is more appropriate.

2.3.1 Job Design

Job design can make an impact to which structure will be more appropriate for the firm. Hubbard states that drivers can engage in two sorts of activities: driving the truck and performing non-driving service activities (George P. Baker 2002). Service activities are other tasks that are in addition to driving, loading, and unloading. An example of this would be for a driver being required to have knowledge of handling hazardous materials. Baker also notes that benefits occur when additional services are provided by the driver but rarely exist in bulk goods hauling. A scenario where service activities are warranted would make it difficult for drivers to be incentivized under a contract carrier scenario. When a firm employs the driver it can become more cost effective to provide training to ensure the additional services are performed to satisfaction. From a job design perspective, grain hauling would serve no benefit to having a driver with service responsibilities due to the simple nature of the logistical functions performed when hauling a bulk commodity. A conclusion was drawn with the following relationship: "As service responsibilities increase, private ownership increases" (George P. Baker 2002).

2.3.2 Load Matching

The needs of the shipper and the supply of truck capacity available are usually difficult to match. Another area that affects the ownership structure of trucking is the need

to match the demand of the haul and the truck. It is important to consider if the haul will be a roundtrip, front haul, or back haul shipment. Carriers and brokers spend a lot of resources to be in touch with different markets and their demand to have more information on truck movements that shippers are trying to make (George P. Baker 2002). Firms have knowledge limited to the shipments they need to make and have less insight to the needs of other markets. For a shipper that is not performing a round trip movement, a broker or carrier is needed to find a "complimentary haul" in order to maximize the value of the truck and eliminate an empty return trip. A conclusion was drawn with the following relationship: "As the need for complimentary hauls increase, private ownership decreases" (George P. Baker 2002).

The study and analysis performed by the authors was mainly to theorize how ownership structure was affected by OBC technology. The two main outcomes of increased OCB utilization in trucks is to increase tracking and to increase utilization. Trip recorders can be installed to track data for an individual truck to determine how much time is spent on driving versus other activities. Other management systems can be installed to track location to help with scheduling for dispatchers to make operations more efficient. Even though this was the primary focus for the authors, they both recognized the importance of other factors and the influence they pose to ownership structure.

2.3 Outsourcing vs In-Sourcing Logistics

Managing a complete supply chain from start to finish is a difficult task to achieve. Learning from the way other industries handle transportation for their own supply chain

can provide a means to assess the decision criteria used to decide which method is the best fit for the business. At the Council of Supply Chain Management Annual Global Conference in 2011, two case studies were presented; 1)"Outsource" by Bill Pollard the VP of Customer Service and Transportation at Del Monte Foods, 2) "In-Sourced" by Todd Jackson the President at Alliant Logistics (Gonzalez 2011). The summary of the two case studies came down to three decision factors when choosing between in-sourcing and outsourcing.

2.3.1 Core Competencies

Activities that represent a core competency to the business should remain in-house and all other activities should be outsourced. To determine core competencies, a strategic team is assembled to define today's businesses core competencies and what they need to be moving forward.

2.3.2 Outsourcing Flexibility

Once the decision is made to outsource a business function, losing the ability to change the strategy may become a problem. The nature of the relationship between the business and outsourcing partner can change resulting in the need to switch back to an in-house strategy. Managing the nature of the relationship between outsourcing partners is important as time goes on as business is not static and requires change.

2.3.3 Blended Approach

With more complex supply chains that involve more distinct functions, taking a hybrid approach is now possible where it was not before. Outsourcing partners today offer custom solutions to fit the need of the business by eliminating the "all or nothing" option

(Gonzalez 2011). The ability to be flexible makes outsourcing an option that can be applied to more business today than ever before.

2.4 Outsourcing Transport and Logistics Services

Logistics outsourcing has changed throughout the years as levels of integration and service have increased. For companies outside of agriculture in other industries, the logistics portion of the supply chain function takes on more levels of activity. The decision on what to outsource is a complex question to ask and gets to the core of the make or buy decision. Typical thought is for companies to focus on core competencies or activities that they have a competitive advantage. Cost has been dominant driver in the make vs buy decision historically, however this has changed today to a more strategic approach. A basic framework for making logistics based outsourcing decision is represented by a study conducted in 2007.

Figure 2.3: A Framework for Logistics Outsourcing Decisions

Is logistics a critical success factor in this market?		Is logistics a core competency in the business? **No**	Is logistics a core competency in the business? **Yes**
	Yes	Outsource functions, maintain control of process	Perform in-house
	No	Outsource	Spin off

Source: (Ogorelc 2007)

With the framework in mind, outsourcing decisions are largely based on criticality to success and whether or not logistics is a core competency for the business (Figure 2.3). To use this framework, a firm answers two questions: 1) Is logistics a critical success factor in this market? 2) Is logistics a core competency in the business? Depending on whether the answer is yes or no to each question, a box exists that provides the best course of action for the firm to take regarding logistics. Complete outsourcing should be done when the answer is "no" to both questions. Keeping logistics activities in house is best if the answer is "yes" to both questions. When logistics is deemed critical to success in the market but not a core competency for the business, outsourcing is the best course of action. When the opposite is true, it is best to spin off this function of the business.

2.4.1 Reasons for outsourcing

Another explanation for the reasoning behind outsourcing by companies is based more on costs and efficiencies. The logic was to choose the path that led to bigger costs savings for the company. The more modern approach is to examine the problem from a strategic level to understand the impact to the business. The following factors have been shown to be reasons for outsourcing according to a study conducted to examine the motivations behind outsourcing (Kakabadse 2000).

1) Economic - outsourcing firms have greater levels of specialization and are more efficient creating economies of scales.
2) Quality - outsourcing firms have high skill levels and capabilities beyond what is capable internally.
3) Innovation - improvements in technology and quality through innovation.

These factors serve to create cost savings for the company that decides to outsource. Outsourcing companies combine economies of scale, expertise, capital investment, and the technology to be a more efficient provider of the service being outsourced. Figure 2.4 highlights reasons to make and reasons to buy when making a decision regarding logistics (Kakabadse 2000).

Figure 2.4: Make or buy decision in logistics

Reasons to Make:	Reasons to Buy:
Core competencies	Acquire quality source of services
Competitive issues	Lack of capacity
Inadequate supply	Lack of logistics knowledge
No capable suppliers	Management focus
Lower production cost	Avoid major investments
Specialization	Reduce logistics costs

Source: (Ogorelc 2007)

The summary of the article supports the notion that outsourcing has shifted from practice of saving cost to being more strategic. Logistics as a business function has to be looked at differently to assess the value it brings to the business. Using the framework above as a reference for decision making, companies can make a better strategic decision towards the most optimal solution possible both now and in the future.

CHAPTER III: DATA ANALYSIS AND METHODS

The following section provides an explanation of the data used for this study. Fixed and variable costs are discussed with a brief description of how the data is used and how the data is obtained. Each variable fits into a model used to compare the make vs buy cost structure. National averages are used when regional averages are unavailable or would in other case skew the validity of the variable being used.

Fixed costs are expenses incurred that are not dependent on output. In this case, the truck and trailer represent the fixed costs associated with the project. This also represents the initial investment cost needed to make a buy decision for truck logistics. Fixed costs are not variable in the short run but are variable in the long run as equipment is turned over and re-purchased. Variable costs on the other hand are expenses incurred that are dependent on output. Each additional unit of output will have an accompanying level of cost associated with it. Under average conditions, the variable costs associated with running a truck are 90% of the total cost of operation.

3.1 Fixed Costs – Truck/Trailer Ownership

The truck and trailer cost are important items to consider when analyzing the total costs associated in the make vs buy decision. This represents the largest portion of the initial cost of truck ownership and its impact is reflected in the cost calculator used later in this study for analysis.

Truck Cost – As of 2013, the average age of a Class 8 semi-tractor on the road was 6.5 years old (Staff 2012). When deciding on what type of truck would be sufficient, 6.5 was used to search for used tractors in within 6-7 years old. Focus was given to tractors that were day

cabs since the driver would not perform overnight hauls. The average price for a semi-tractor of that age and configuration was around $50,000.

Grain Trailer – Many options are available for grain trailer manufacturers and configuration. A hopper bottom trailer is preferred for hauling grain due to capacity and ease of unloading. Buying a used trailer was determined to be the best option for this study. Used trailers cost less but have the potential to have hidden problems in components and repair work that needs done that can add up to the cost of purchasing a new trailer (News 2002). Taking this into consideration, it was appropriate to search for trailers that were hopper bottom, 40 to 42 feet long, and as close to new as possible. The average price for a trailer for was around $30,000.

3.2 Operational Data

The following items are important factors needed to make the cost calculator function correctly to achieve costs in a manner that can be interpreted on a per bushel or per mile basis. Descriptions below for each item are used to give clarity and meaning to how they fit in respect to the cost calculator that has been created to compare make vs buy truck ownership.

Annual Miles Driven – Further calculation was made for how many loads a truck can get per day multiplied by working days with an estimate of harvest month increase in loads per day. This calculation was also compared to what local owner/operators reported as an annual average for miles driven that operate as full time grain haulers in similar situations.

Bushels Per Load - Depending on what commodity is being hauled, the bushels are calculated by taking the net weight divided by 56 or 60. For corn and sorghum, the industry

standard is 56lbs, for wheat and soybeans the industry standard is 60lbs. Because corn and milo make up the larger percentage of grain hauled for this study, it was appropriate to use 56 as a divisor. Using this number, an average load should be close to 950 bushels for the truck to stay within the state limits for maximum weight allowed.

Percent of Miles Loaded – Using 60% as an assumption for this variable means the truck will have grain on it 60% of the time. Most of the time a truck is only loaded on one leg of a trip, but in some cases it is possible to find a backhaul opportunity to where the truck is loaded on both legs of the trip.

Length of Average Trip, One Way – This calculation is made by determining the average one-way trip length for hauling grain given the customer base and proximity of fields.

Average Driving Speed – This calculation is found to be an industry standard number from multiple sources. This takes into account going through cities, loading, unloading, and any other stoppage in route. The American Transportation Research Institute used a survey to estimate a 39.98 mph operational speed average from which further cost calculations are based on (ATRI 2015).

Diesel Price Per Gallon – According to the Energy Information Administration, the average price of highway diesel in the Midwest for 2015 was $2.64 per gallon (Table 3.1) while the 15 year average from 2000-2015 was $2.66 (Table 3.1). Fuel costs in general have decreased since the end of 2015 further reducing the marginal cost for operating a truck. An annual average will better allow for an accurate cost estimation to reduce variability with the results.

Table 3.1: EIA Diesel Prices in Midwest for 2015

Date	Midwest No 2 Diesel Ultra Low Sulfur (0-15 ppm) Retail Prices (Dollars per Gallon)
Jan-2015	$2.95
Feb-2015	$2.79
Mar-2015	$2.80
Apr-2015	$2.67
May-2015	$2.76
Jun-2015	$2.76
Jul-2015	$2.68
Aug-2015	$2.51
Sep-2015	$2.46
Oct-2015	$2.57
Nov-2015	$2.48
Dec-2015	$2.26
Average	$2.64

Source: (EIA.gov 2016)

Table 3.2: EIA Diesel Prices in Midwest for 2000 – 2015

Date	Midwest No 2 Diesel Ultra Low Sulfur (0-15 ppm) Retail Prices (Dollars per Gallon)
2000	$1.47
2001	$1.40
2002	$1.31
2003	$1.49
2004	$1.77
2005	$2.36
2006	$2.67
2007	$2.86
2008	$3.76
2009	$2.43
2010	$2.96
2011	$3.80
2012	$3.90
2013	$3.90
2014	$3.81
2015	$2.64
Average	$2.66

Source: (EIA.gov 2016)

Average Miles Per Gallon – New trucks are reported to be able to achieve efficiencies in the 6 mpg range. A conservative number that local operators have reported as an average is in the 4-5 mpg range. A local source that hauls grain on similar terms to the proposed scenario has reported mileage to be 4.5 mpg.

Wage Rate per hour – A figure of $13.50 per hour represents the average expected rate a company employed truck driver could expect to get in central Kansas. Local contract carriers confirmed this value is appropriate.

Insurance, Tags, and Property Tax – This information was obtained from a local owner/operator that has similar equipment to what would be purchased and used. The figures

used presented are for commercial level insurance that meets the requirements that grain companies set as policy.

3.3 Annual Operating Costs

The following operating costs represent the variable costs for truck ownership. Each item is calculated based on actual data from contract carriers. The variables listed represent the majority of the operational costs of running a truck that are incurred.

Truck Tires – Typical lifespan for tires are 100,000 miles on average. The actual lifespan will vary depending on the surface a truck is driving on. Most trucks will drive on both gravel and paved roads. In this study, the annual cost for tires is weighted in respect to the miles driven versus the life of the tire.

Service – This item covers normal interval work that needs to be done such as oil changes, oil filters, air filters, fuel filters, grease, and other fluid changes. Basic services that most drivers are capable of doing on their own and that do not require time in the repair shop.

Maintenance – For more complex service that takes place, those items fall under maintenance items. Most of this work will require going to a shop and having them perform the work because of specialty tools, equipment, and time needed. Some items that fall under this list are brake drums, seals, bearings, pumps, belts, and other consumable parts. This category will largely depend on the age and miles on the truck but most items would be done annually regardless. Any required inspections would also be accounted for in this figure.

Incremental Maintenance – An industry used category that accounts for the added maintenance cost incurred as miles traveled increase. A local owner/operator indicated that 10% is a commonly used number that would account for the added maintenance a truck

would expect to see based on miles traveled. Taking the total miles traveled in a year multiplied by .10 would equal the incremental maintenance cost.

3.4 Analytical Methods

Break-even-analysis is the primary analytical approach used in this study given the background for the project. Data is collected from national and local sources to obtain the most accurate and applicable values to use for the analysis. The creation of a cost calculator is necessary to develop cost data for the given scenario of choice to compare to any alternative. For analysis to be done on a comparative level, it is critical to convert the cost in a common language of dollars per bushel or dollars per mile. An important factor to break-even-analysis is creating the cost calculator in a way that allows for change to explore different scenarios. Assumptions are made for some of the variables in the spreadsheet so a person can manipulate them to see how the total cost will be impacted.

NPV and IRR are the secondary methods used in this study to evaluate the attractiveness of this project as a capital expenditure. Net Present Value is used to analyze the profitability of a project by valuing discounted cash flows against the capital investment that must be made. Internal Rate of Return is a method of determining the profitability of a project by calculating the interest rate necessary to make the NPV of all cash flows equal zero. Breakeven analysis will be valuable in producing annual expense data to apply towards the input needed to find a NPV of the project.

CHAPTER IV: RESULTS

4.1 Analytical Results

The primary analytical method chosen for this thesis project is to perform breakeven analysis to better understand the costs associated between the make vs buy decision. This approach is the most applicable evaluation method for a business to compare with competing strategic or capital projects. In order to do the analysis, it is necessary to create the Truck Cost Calculator shown in Table 4.1 for fixed and variable costs of operating a truck in house. The model below is intended to simulate an average year for a truck to transport grain for a facility centered around Pratt County, KS. This model takes into account the volume handled for the entire year which include harvest time activity as well as commercial activity during non-harvest times. The variables as explained earlier are based on the most accurate market rates available to the region. The goal of the model is to best represent the most realistic cost scenario for operating a truck in house by a business and see how that compares to outsourcing the same truck.

Conducting sensitivity analysis to the study results in a net zero effect when comparing the make vs buy decision based on variable costs. The price of diesel fuel would be an example of this as all trucks whether company owned or not would both see an increase in operational costs as fuel prices rise. Fuel and labor make up 83% of the variable costs involved in operating a truck and trailer. As the two variables move up and down, the overall cost to the business is generally offset by the broader market. Grain companies monitor freight costs and will adjust the value they are willing to buy and sell in response. Changes in the cost of freight for agricultural products are essentially reflected by raising and lowering grain bids in different markets.

4.2 Cost Comparison

4.2.1 Average Volume Year

Using the output from the Truck Cost Calculator in Appendix A, some valuable insight is gained when looking at the values. The values highlighted in green are input manually and the rest is generated by formulas within the spreadsheet. Variables used in the calculator are listed and described in Chapter III. The critical output is the total bushels hauled, the cost per bushel, and total cost. To further explain, the proposed scenario to purchase and operate a truck and trailer for hauling grain would result in an annual total of 3,135,000 bushels hauled at a rate of $.062 per bushel for a total cost of $194,529.07. This represents maximum utilization of the truck that could be achieved based on the miles driven in a year and applicable percent of backhauls performed. When comparing the cost of hauling grain, brokers usually look at the cost per mile based on current market rates to obtain a cost per bushel rate. For this scenario, a $1.62 per mile average is achieved which in most cases is lower rate than freight brokers or contract carriers are willing to haul for. For contract carriers, harvest rates can range up to $2.50 per mile and be as low as $1.55 per mile outside of harvest when truck supply is higher.

Comparing the costs generated above to the cost of outsourcing freight in current market conditions gives us an indication of what is the most optimal choice from a simple cost standpoint. For contract carriers, the cost per bushel will be closer to $.08 which is much higher than the $.062 per bushel for a company owned truck. This higher cost per bushel would result in a total annual cost of $250,800 to haul the same 3,135,000 bushels of grain as the company owned truck would. By choosing the option to purchase a truck and operate it, the cost savings would be $56,270.93 annually in the first year. If a person were to just

look at the best choice option this way, a strong case can be made that the right choice is to purchase a truck and trailer and perform logistics in house.

Breakeven analysis was used to determine the bushel quantity hauled that makes each option equal in cost. Owning and operating a truck is more expensive until 974,463 bushels have been hauled that makes the cost per bushel amount $0.08, or equal to the contract carrier rate. This bushel quantity is 31% of the expected amount that a truck would haul on an annual basis according to the proposed scenario in the spreadsheet above. One reason why the breakeven number is so low is because the fixed cost of operating a truck are only 22% of the total annual cost to operate the truck at breakeven to contract out freight and 9% of the total annual cost when looking at the expected scenario of the spreadsheet. The fact remains that the majority of the costs associated with hauling grain are largely associated with the variable operating expenses.

4.2.2 Reduced Volume Year = 50%

For a smaller volume year where total bushels handled is 50% of an average year, the volume would be 1,567,500 bushels. Appendix C contains a model that represents a 50% volume year for comparison to an average year. Adjusting the model accordingly, the per mile rate is $1.83 while the per bushel rate is $.07. The contract carrier rate per mile is $2.09 while the per bushel rate is $.08. The total cost difference is $109,954.53 for in house vs $125,400.00 for a contract carrier. For a 50% crop year, operating a truck in house would result in a savings of $15,445.47 to the business. One consideration for short crop years is that market freight rates will more than likely drop with the extra supply of trucks available which would skew the breakeven results from what is calculated above. A 50%

crop year was chosen because utilization below that mark would be an unlikely event to occur.

4.3 Strategic Decision Factors

When conducting literature review for this project, it was clear that using total cost economics as the singular decision factor for a make vs buy decision was a largely outdated practice. A more modern approach is to look at the activity from a strategic perspective with other decision factors in addition to cost. The following analysis is for some of the other decision factors found from the literature review above, and how they pertain to this project.

4.3.1 Flexibility

Having the ability to purchase grain on a F.O.B basis gives the grain facility greater flexibility in delivery and marketing options. Since ownership of the commodity is transferred at the origin point, the purchaser is able to then decide where the destination point will be. Resellers make a living from buying grain picked up and selling grain delivered. Being able to choose the delivery point also allows for arbitrage opportunities. During harvest periods arbitrage is unlikely to happen when looking at it from a producer point of view, but outside of harvest much more opportunity exists.

4.3.2 Freight Control

The ability to manage as much risk as possible during a transaction is important to successful execution of a trade. For a grain facility to take on the transportation obligation in the transaction, they are reducing the risk for the other party which can be seen as value added. Producers selling grain on a F.O.B basis no longer have to own a truck and trailer, hire a driver, perform maintenance on the equipment, or deal with the process itself of

hauling grain which can save time. Grain companies performing in house logistics can benefit from reduced costs associated with re-routes. Contract carriers are not as flexible and cost effective when loads have to be re-directed which happens frequently in grain trade.

4.3.3 Core Competency

This decision factor will vary between grain companies and is more of a case by case situation whether logistics is seen as a core competency to the business. Guarding freight lanes and making strategic freight moves can bring extra value to grain companies. Knowing what geographical areas have higher chances of getting backhaul loads can provide savings to make trade more profitable. Each business must define how important owning the logistics of grain trading is to the business from a competitive level and make the decision.

4.4 Net Present Value and Internal Rate of Return

Calculating the net present value of a project is imperative when deciding whether or not to move forward with a project and how it compares to other investment options. For this thesis, finding the net present value for buying a truck and trailer to operate provides a deeper level of insight into how attractive the project can be. Before taking on any project, it is critical to estimate the profitability that may exist.

Net Present Value is used to analyze the profitability of a project by valuing discounted cash flows against the capital investment that must be made. The mathematical formula for finding net present value is expressed by the following:

$$NPV = -C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + ... + \frac{C_T}{(1+r)^T}$$

$-C_0 = Initial\ Investment$
$C = Cash\ Flow$
$r = Discount\ Rate$
$T = Time$

The formula above gives us an expanded version of how to calculate net present value using discounted future cash flows with a cash outflow that represents the initial investment cost. The sum of the discounted cash flows can be rewritten as the following formula:

$$NPV = -C_0 + \sum_{i=1}^{T} \frac{C_i}{(1+r)^i}$$

Applying this financial tool to the project provides valuable information to make an investment decision. Cost data was derived from Table 4.1 that describes the annual operating costs that we compare against annual revenues to find out what the cash flow would be per year. The initial investment is $80,000 with annual cash flows of $56,270. The seventh year cash flow is $58,370 to account for the $3,000 salvage value. The life of the project is set at 7 years, with a discount rate of 7% to represent the cost of capital to finance the investment. Table 4.4 below shows the discount cash flows used to find a net present value.

Table 4.4 NPV Example

Net Present Value		Cash Flow Per Period				
		0	1	2	3	4
$224,563.09		(80000.00)	52588.79	49148.40	45933.08	42928.11
		5	6	7		
7% Discount Rate		40119.73	37495.08	36349.90		

For this project, the net present value is $224,563.09 using a 7% discount rate given the cash flows in the table above. The importance of this output illustrates the value owning and operating a truck has over contract carrier freight. The cash flows in this example are based on an average year, if the expected volume is reduced to 50% of average, cash flows are $15,448 resulting in a net present value of $4,561.52. Both scenarios result in a positive net present value indicating the project is attractive to pursue. While this is not an exact value for what the project would return, it provides an estimate that closely resembles the profit potential available.

The internal rate of return is a financial tool that is closely related to net present value. This tool uses the same cash flows as used to find net present value to find the discount rate at which the project would breakeven. Hence, continue with the project as long as the internal rate of return is higher than the discount rate or hurdle rate the company sets. When calculating the IRR from Table 4.4, the result is a 69% internal rate of return. Since 69% is greater than the 7% discount rate set in this example, provides a basis to move forward with the project. It is important to note that the IRR of a project can be misleading because it does not tell any information related to the actual dollar value of the project.

CHAPTER IV: CONCLUSION

This thesis project has been instrumental towards the following research question. How can grain companies combat an environment of oligopoly to create better value to the customer and differentiate themselves from the competition? Answering the question can be done in many different ways, but this project narrows the focus to logistics. The purpose of this project is to compare different logistical support options grain companies can utilize to create better value to the customer and differentiate themselves among the competition. The objective is to determine which alternative is the most economic for a grain facility located in central Kansas. Deciding on which option to choose for a grain company evaluating the make vs buy truck logistics decision is a function of individual company strategy. The economic cost using breakeven analysis simplifies the decision on a monetary basis, but fails to completely answer which option is best. The process of answering which option created the best value for a grain company started by gathering cost information for both options and finished by creating a cost calculator. Based on the scenario proposed in the model (See APPENDIX B), the "make" decision to operate a company owned truck provided a savings of $56,270.93 in the first year vs using a contract carrier. That represents the cost savings of transportation, not taking into account the additional revenue generated trading the grain that is hauled. Based on these cost savings, a net present value was obtained that further reinforces the economic benefits of not outsourcing logistics for this project. The NPV for the project was $224,563.09 with an IRR of 69%. Being able to offer logistical services to customers creates better value to them and offers additional revenue to the business.

Once we understand the cost component to the decision, we can look at strategic decision factors. Even though the financial impact carries considerable weight to the optimal choice, other factors are valuable to consider as learned from the literature review performed for the project. A framework for the insourcing vs outsourcing decision was given by Figure 2.3 and Figure 2.4. In this project using Figure 2.3, I concluded that both answers were a yes. Logistics is both a critical success factor and a core competency to the business. Grain companies seeking to differentiate themselves can do this by adding logistics as a service and using prior knowledge of the grain trade to maximize the opportunity for that service. In this project using Figure 2.4, I concluded that more reasons exist to make than to buy when applying the framework to make the decision. The choice to make vs buy will vary using this framework to a large degree based on the company and what resources and capabilities they may have. Given the following conclusions from evaluating the make vs buy decision, I can conclude that the objective of this thesis project was met.

The applicability of this thesis is primarily for the grain industry and will be less appropriate for other industries and regions as well. The costs data is relatable to other industries and using the format of the model above, an individual can manipulate variables for a scenario more appropriate to their individual business. Assumptions were made for contract carrier rates based on the authors individual knowledge of the industry from prior experience and may vary based on the region of the country. Cost data was gathered with the intent to be most accurate for Pratt County, KS as well.

Further research can be conducted for more complex supply chains outside of the agricultural industry that rely on advance levels of technology. Supply chains with greater

complexity would also be an area of further study to see how the decision factors affect the optimal solution for logistics make vs buy decision.

WORKS CITED

Agriculture, United States Department o. 2015. "Transportation of U.S. Grains: A Modal Share Analysis 1978-2013 Update." *Agficultural Marketing Service.* June. Accessed June 21, 2017. https://www.ams.usda.gov/sites/default/files/media/ModalJune2015.pdf.

Association, National Grain and Feed. 2015. *NGFA Grain Trade Rules.* September 13. Accessed February 22, 2016. https://www.ngfa.org/wp-content/uploads/Oct.-2015-Grain-Trade-Rules.pdf.

ATRI. 2015. *An Analysis of the Operational Costs of Trucking: 2015 Update.* September. Accessed February 12, 2016. http://atri-online.org/wp-content/uploads/2015/09/ATRI-Operational-Costs-of-Trucking-2015-FINAL-09-2015.pdf.

Coase, Ronald. 1960. "The Problem of Social Cost." *Journal of Law and Economics, The University of Chicago Press, Vol. 3* 1-44.

EIA.gov. 2016. *Gasoline and Diesel Fuel Update.* March 6. Accessed March 10, 2016. http://www.eia.gov/petroleum/gasdiesel/.

FAO. 2008. *How to Feed the World in 2050.* Accessed February 5, 2017. http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf.

George P. Baker, Thomas N. Hubbard. 2002. *Make Versus Buy in Trucking: Asset Ownership, Job Design and Information.* August. Accessed October 2016. http://www.kellogg.northwestern.edu/faculty/baliga/htm/papers/bakerhubbardmb.pdf.

Gonzalez, Adrian. 2011. *Logistics Outsourcing vs. In-Sourcing: Three Questions to Consider.* October 19. Accessed February 26, 2017. https://logisticsviewpoints.com/2011/10/19/logistics-outsourcing-vs-in-sourcing-three-questions-to-consider/.

Kakabadse, Nada and Kakabadse, Andrew. 2000. "Critical Review - A paradigm shit." *Journal of Management Developement* 670-728.

News, Farm Industry. 2002. *Grain trailers for the long run.* May 1. Accessed February 16, 2016. http://farmindustrynews.com/grain-trailers-long-run.

Ogorelc, Anton. 2007. *http://www.fpz.unizg.hr/traffic/index.php/PROMTT/article/viewFile/972/822.*

October 5. Accessed February 28, 2017. http://www.fpz.unizg.hr/traffic/index.php/PROMTT/article/viewFile/972/822.

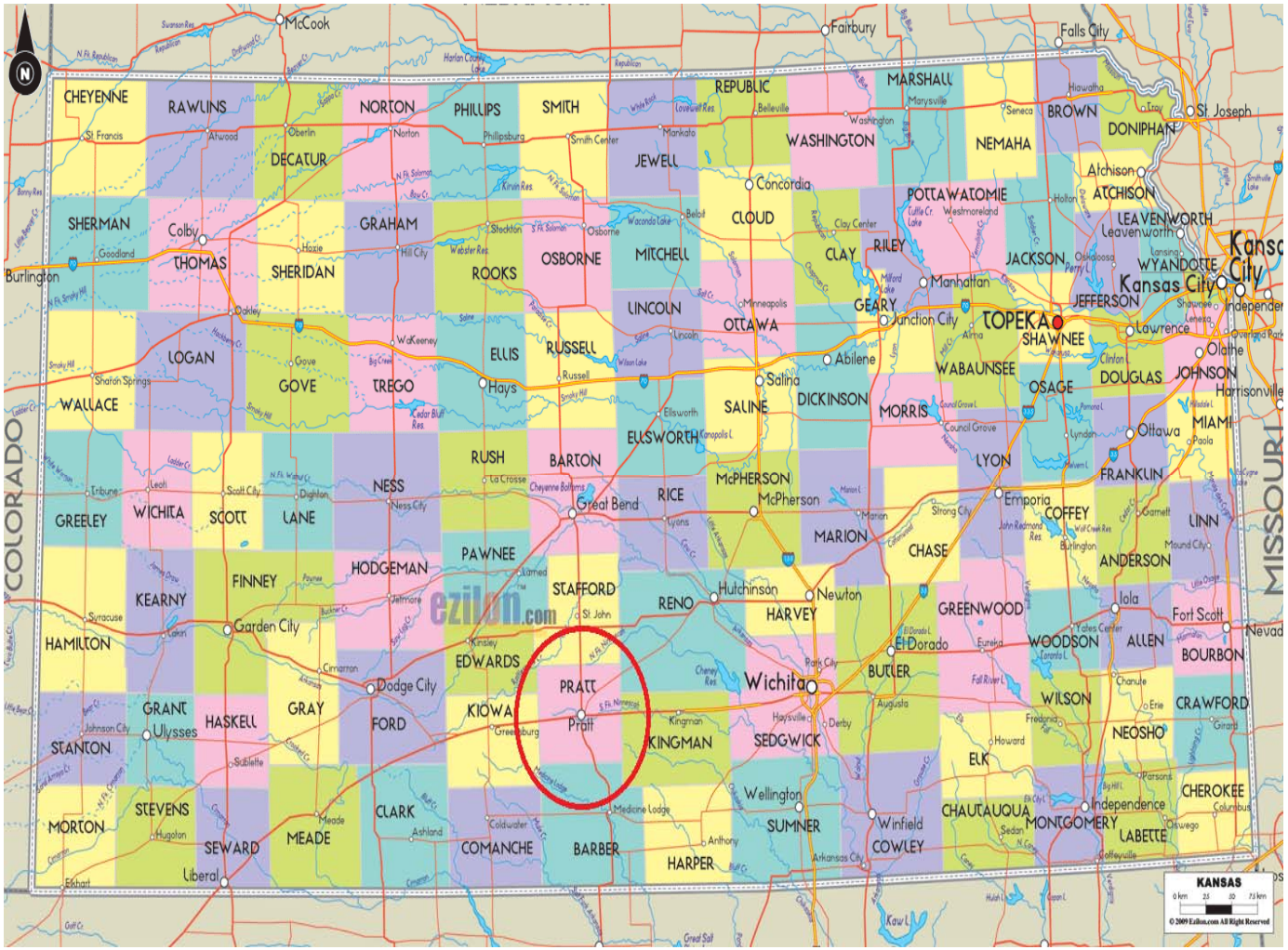
Research, KU Institute for Policy and Social. 2015. *Kansas Statistical Abstract Enhanced Online Edition.* September. Accessed March 18, 2016. http://www.ipsr.ku.edu/ksdata/ksah/ag/.

Staff, Overdrive. 2012. *Age of U.S. fleets spikes during recession.* Agust 10. Accessed February 15, 2016. http://www.overdriveonline.com/aging-u-s-fleets/#.

USDA. 2016. *World Agricultural Supply and Demand Estimates.* August 12. Accessed August 16, 2016. http://www.usda.gov/oce/commodity/wasde/latest.pdf.

USDA, NASS -. 2016. *2015 State Agricultural Overview - Kansas.* August 16. Accessed August 16, 2016. https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=KANSAS.

APPENDIX A


McCook
Fairbury
Falls City
CHEYENNE
RAWLINS
NORTON
PHILLIPS
SMITH
REPUBLIC
MARSHALL
BROWN
DONIPHAN
St. Joseph
WASHINGTON
NEMAHA
DECATUR
JEWELL
Concordia
Atchison
ATCHISON
POTTAWATOMIE
SHERMAN
Colby
GRAHAM
CLOUD
LEAVENWORTH
Leavenworth
THOMAS
SHERIDAN
ROOKS
OSBORNE
MITCHELL
CLAY
RILEY
JACKSON
WYANDOTTE
Kansas City
Burlington
Manhattan
JEFFERSON
LINCOLN
OTTAWA
GEARY
Junction City
TOPEKA
SHAWNEE
Lawrence
Olathe
LOGAN
ELLIS
RUSSELL
Abilene
WABAUNSEE
DOUGLAS
JOHNSON
GOVE
TREGO
Hays
Salina
OSAGE
WALLACE
SALINE
DICKINSON
MORRIS
MIAMI
ELLSWORTH
Ottawa
RUSH
BARTON
LYON
FRANKLIN
NESS
McPHERSON
RICE
Great Bend
McPherson
Emporia
COFFEY
GREELEY
WICHITA
SCOTT
LANE
MARION
CHASE
LINN
PAWNEE
ANDERSON
HODGEMAN
FINNEY
STAFFORD
Hutchinson
Newton
Iola
KEARNY
RENO
HARVEY
GREENWOOD
Fort Scott
Garden City
HAMILTON
EDWARDS
El Dorado
WOODSON
ALLEN
BOURBON
Dodge City
PRATT
BUTLER
Wichita
GRANT
HASKELL
GRAY
KIOWA
WILSON
CRAWFORD
Ulysses
FORD
Pratt
KINGMAN
SEDGWICK
NEOSHO
STANTON
ELK
STEVENS
CLARK
Wellington
CHEROKEE
MORTON
Independence
CHAUTAUQUA
MONTGOMERY
SEWARD
MEADE
COMANCHE
BARBER
SUMNER
Winfield
COWLEY
LABETTE
HARPER
Liberal
KANSAS
COLORADO
MISSOURI
ezilon.com

APPENDIX B

Truck Cost Calculator

Tractor/Trailer Investment Cost				
Truck	$ 50,000.00			
Depreciation	14.00%			
Grain Trailer	$ 30,000.00			
Depreciation	10.80%			
Interest Rate	7.00%			
Truck Operational Data				
Annual Miles driven	120,000			
Bushels per load	950			
Percent of miles loaded	55%			
Annual Loaded miles	66000			
Annual Empty miles	54000			
Length of average trip, one-way	20			
Number of trips per year	3300			
Average driving speed	40.00			
Diesel price per gallon	$ 2.50			
Average miles per gallon	4.5			
Wage rate per hour	$ 13.50			
Labor hrs/hr of driving time	2			
Total Bushels Hauled Annually	3,135,000			
Annual Fixed Costs for Tractor/Trailer		Annual	Per Mile	Per Bushel
truck depreciation		$ 7,000.00	$ 0.0583	$ 0.0022
truck interest		$ 3,500.00	$ 0.0292	$ 0.0011
truck insurance		1000	$ 0.0083	$ 0.0003
truck tag		140	$ 0.0012	$ 0.0000
trailer depreciation		$ 3,240.00	$ 0.0270	$ 0.0010
trailer interest		$ 2,100.00	$ 0.0175	$ 0.0007
trailer insurance		150	$ 0.0013	$ 0.0000
trailer tag		25	$ 0.0002	$ 0.0000
property taxes		425	$ 0.0035	$ 0.0001
		$ 17,580.00	$ 0.147	$ 0.006
Annual Operating Costs		Annual	Per Mile	Per Bushel
Truck Tires		$ 9,482.40	0.0790	$ 0.0030
Service		$ 4,800.00	0.0400	$ 0.0015
Maintenance		$ 3,000.00	0.0250	$ 0.0010
Incremental Maintenance		$ 12,000.00	0.1000	$ 0.0038
Fuel		$ 66,666.67	0.5556	$ 0.0213
Labor		$ 81,000.00	0.6750	$ 0.0258
		$ 176,949.07	$ 1.4746	$ 0.0564
Total Cost		$ 194,529.07	$ 1.62	$ 0.062

APPENDIX C

Truck Cost Calculator – 50% Year

Tractor/Trailer Investment Cost				
Truck	$ 50,000.00			
Depreciation	14.00%			
Grain Trailer	$ 30,000.00			
Depreciation	10.80%			
Interest Rate	7.00%			
Truck Operational Data				
Annual Miles driven	60,000			
Bushels per load	950			
Percent of miles loaded	55%			
Annual Loaded miles	33000			
Annual Empty miles	27000			
Length of average trip, one-way	20			
Number of trips per year	1650			
Average driving speed	40.00			
Diesel price per gallon	$ 2.50			
Average miles per gallon	4.5			
Wage rate per hour	$ 13.50			
Labor hrs/hr of driving time	2			
Total Bushels Hauled Annually	1,567,500			
Annual Fixed Costs for Tractor/Trailer		Annual	Per Mile	Per Bushel
truck depreciation		$ 7,000.00	$ 0.1167	$ 0.0045
truck interest		$ 3,500.00	$ 0.0583	$ 0.0022
truck insurance		1000	$ 0.0167	$ 0.0006
truck tag		140	$ 0.0023	$ 0.0001
trailer depreciation		$ 3,240.00	$ 0.0540	$ 0.0021
trailer interest		$ 2,100.00	$ 0.0350	$ 0.0013
trailer insurance		150	$ 0.0025	$ 0.0001
trailer tag		25	$ 0.0004	$ 0.0000
property taxes		425	$ 0.0071	$ 0.0003
		$ 17,580.00	$ 0.293	$ 0.011
Annual Operating Costs		Annual	Per Mile	Per Bushel
Truck Tires		$ 4,741.20	0.0790	$ 0.0030
Service		$ 4,800.00	0.0800	$ 0.0031
Maintenance		$ 3,000.00	0.0500	$ 0.0019
Incremental Maintenance		$ 6,000.00	0.1000	$ 0.0038
Fuel		$ 33,333.33	0.5556	$ 0.0213
Labor		$ 40,500.00	0.6750	$ 0.0258
		$ 92,374.53	$ 1.5396	$ 0.0589
Total Cost		$ 109,954.53	$ 1.83	$ 0.070