ANALYSIS OF PICKLE PACKAGING EQUIPMENT

by

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ABSTRACT

Best Maid is a middle-sized regionally orientated company, headquartered in Fort Worth, Texas. It is currently owned and operated by the fourth generation of the Dalton family. The company specializes in the production of pickles and condiment products and currently holds the title of #1 retail brand of pickles in the state of Texas. In addition to the Best Maid label, products are also produced under the Del-Dixie label.

The objective of this thesis is to analyze a potential capital project: a bucket line replacement. The analysis will be completed by using net present value to determine the cost and benefits of the project. The focus of the project will be the food service bucket line. The current line was designed and installed over 20 years ago. Currently, this line and supporting resources require a staff of 17 employees to operate. The process is looking to be improved through advances in technology including vibratory conveyors, more complex PLC programming, and increased accuracy of scaling equipment. Implementing these advancements has the potential to reduce the employee labor cost as well as decrease over-scaling. The goal of this project is to inform the Best Maid owners of the investment costs, labor savings, benefits, and the financial viability of the proposed capital investment.

Best Maid has consistently grown at a high single digit to low double digit rate each year. Businesses must continually identify and react to the needs of tomorrow, today. Formal processes within the business will be established to evaluate and prioritize future potential projects.

The conclusion of the analysis resulted in a positive NPV of about $567 thousand and a favorable IRR. The recommendation is to adopt the new technology.

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ACKNOWLEDGMENTS

The author wishes to dedicate this thesis to his father, Jim Witt. It's truly an honor to have someone that I admire, value, and can turn to for advice and support. Completion of this program wouldn't have been possible without the support my wife, Allison and children, Mary Kathryn, James, and Caroline. A special thanks to the professors and support staff involved with the MAB program at Kansas State University.

CHAPTER I: INTRODUCTION

1.1 Company Background

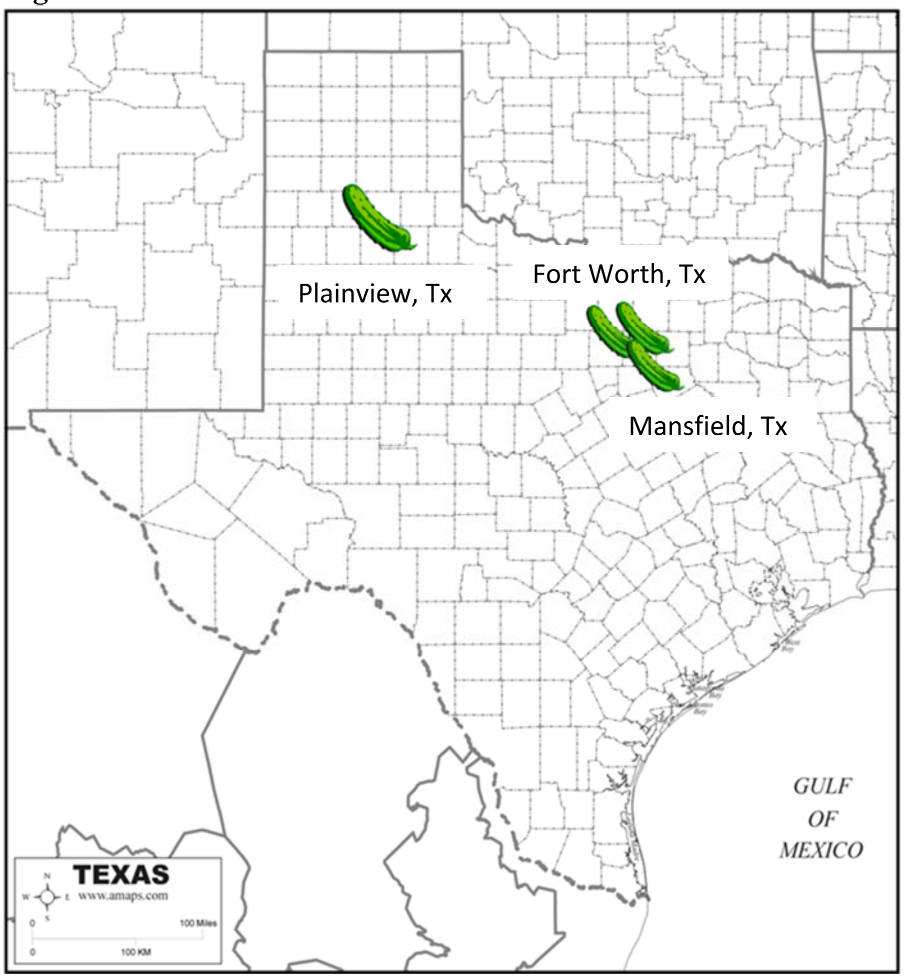
Dalton's Best Maid Products started in 1926. Mildred Dalton and her husband, Jessie, owned a small grocery store just south of downtown Fort Worth, Texas. Mildred would make baked goods daily for the grocery store, but did not have any use for the leftover egg yolks. One day in 1924, she decided that she would start making mayonnaise, and before long it was the local favorite. Eventually, Mildred wanted to expand her offering to include a new sandwich spread. However, there was a problem: the sandwich spread required pickle relish as a main ingredient. The Daltons did use a supplier for a short time, but were forced to consider other options as the relish price increased. So they planted a small plot of cucumbers in their home garden. As the tale goes, the ensuing harvest was so plentiful that the Daltons began packaging pickles, and Best Maid Products was born (Dalton 2013).

Today Best Maid Products is in its fourth generation of family ownership. Gary Dalton, CEO, is Mildred Dalton's grandson and is still active within the company at the age of 78. Brian Dalton, President, is Mrs. Dalton's great grandson. The company is currently positioned as a regional producer boasting the number one pickle label in the state of Texas.

Best Maid owns two product labels: Best Maid and Del-Dixie and offers a product mix of pickles and condiments. The Best Maid label is the flagship of the company and is found statewide. Del-Dixie was acquired in 1962 and is strongest in the Houston and Southeast Texas market areas.

The company is vertically integrated and operates out of four facilities. Field and shed operations are located in Plainview, Texas. Each year the company grows approximately 3,000 acres of cucumbers. Mansfield, Texas is home to the company's 1.5 million bushel fermentation facility. Located about 25 miles away, near downtown Fort Worth, the production and warehouse facilities total about 250,000 square feet.

Figure 1.1: Best Maid Locations



1.2 Project Objectives

The objective of this thesis is to use the Net Present Value (NPV) calculation to analyze a potential capital project: the 5 gallon bucket line replacement. The analysis will be completed by using net present value to determine the cost and benefits of the project. The current line was designed and installed over 20 years ago. Currently, this line and supporting resources require a staff of 17 employees to operate. The proposed investment will improve the process through advances in technology including vibratory conveyors, more complex programmable logic controller (PLC) programming, and increased accuracy of scaling equipment. Implementing these advancements has the potential to reduce the employee labor cost as well as increase the filling accuracy. The goal of this project is to inform the Best Maid owners of the investment costs, labor savings, and impact on cash flow.

1.3 Pickle Process Overview – Field to Packaging

The pickle process starts in the field. Best Maid has a field and grading shed operation located outside of Plainview, Texas. The company contracts about 3,000 acres each year with local growers. The company controls the planting and harvesting, and helps the grower by continually monitoring and advising during the 45 day growth cycle. The cucumbers are sampled daily once they near the anticipated harvest date to ensure the highest density of cucumbers meet the targeted size. Harvest is completed by mechanical means. Best Maid operates two different types of harvesters. There is a fleet comprised of ten specially designed tractors with harvesting attachments and a Vogel. The Vogel is similar to a combine used for wheat harvest, but is specialized for cucumber harvesting. Figures 1.2 and 1.3 show pictures of the different harvesters.

Figure 1.2: Vogel Cucumber Harvester

Figure 1.3: Wildcat Cucumber Harvester

Once picked the cucumbers are transported to the shed for grading. The cucumbers are sized by diameter. During the packaging process, specific sized pickles must be used depending on the final product specifications. The cucumbers are loaded into grain hopper style trucks and shipped that day to either the fermentation facility or the production plant.

At the fermentation facility, often referred to as "the tank yard," the incoming cucumbers are off loaded into large tanks. These tanks are about 12 feet high with a 12 feet diameter. Approximately, one 45,000 pound truck fills one tank. There are over 800 tanks within the confines of the tank yard. The tanks are headed with wood planks to prevent the cucumbers from floating and being damaged by the sun. The tanks are filled with salt water. Tests are performed on each tank to ensure the chemistry is correct. Once the tank's water chemistry is correct and stabilized, a bacterial culture is added to each of the tanks. This culture ferments the sugars within the cucumbers. Tank fermentation depends on the weather, especially the amount of heat. During the hot Texas summers, fermentation can be complete in about 3 weeks. During the winter, it may take a couple of months. Until the tanks have completed the fermentation process they are monitored and tested 2-3 times per week. Upon completion of the fermentation cycle, the cucumber has transformed into “a pickle.”

Every day the production facility calls the fermentation facility to order loads of pickles. The loads of pickles are delivered. The loads are put into tanks inside the plant. Before the pickles can be packed, they must go through a desalination process. A test performed by the quality department verifies when each tank is ready to be used.

1.4 Pickle Process Overview – Bucket Line

Once the quality assurance department verifies the chemistry of a predetermined tank of pickles, production employees dig the pickles out of the tanks and onto the feed conveyor. The pickles are fed across a grader to ensure the proper sized pickles are packed. Pickles of the correct size are visually inspected for defects. A defect is classified as a pickle that is broken, a piece, crooked, of the wrong size, or hollow. After visual inspection, the pickles are put on a machine called a shuffalo. This machine orientates the pickles into a single file line. The lines of pickles are dropped onto a “V-belt” that runs into the Urschel slicer. The blades of the slicer are removed if running whole pickles.

The product passes over a vibrating mesh screen. When running slices this allows the end pieces to fall through to the floor. The new line would collect wasted pieces in a collection bin rather than on the floor. The product vibrates onto an inclined conveyor that takes it up to a drop chute. Five gallon buckets are filled by weight according to each product’s specifications. Every 30 minutes, the quality department checks to ensure the product quality is high. Prior to the pickles being loaded into a bucket, one employee inverts and applies the labels. This employee then places the bucket on the line. One employee is located at the filler and manually pushes the filled bucket off the scale and places an empty bucket back on the scale. After the bucket is pushed off the scale, another employee manually controls a valve to add juice to the bucket. This employee then manually pushes the filled bucket down the line. At the next position, another employee pulls the tub onto a moving conveyor and places a lid on the bucket. The conveyor moves the bucket into position under a hydraulic press with a burper plate attached. The burper press pushes the center of the lid down to secure the lid that reduces the amount of air within the bucket when it is sealed. The bucket is released to move down the line. Next, two employees wipe down the outside of the buckets. The previously noted five positions on the line are the positions that are eliminated with the new line. The buckets are then staged and stacked on pallets. The pallets are then wrapped with a piece of rope, shrink wrapped, entered into the inventory system and loaded on a truck to be moved to the warehouse.

CHAPTER II LITERATURE REVIEW

2.1 Business Environment

The world is being impacted by multiple factors. Leaders in manufacturing environments are continually challenged to decrease cost, increase productivity, juggle a host of responsibilities and still provide customers with a quality product that they find value in.

According to a recent survey of corporate executives, the most important issue facing manufacturing companies is the availability of skilled labor (Moss and Miller 2014). This is a shift from previous years, where labor costs moved from the number one position back to number three (Moss and Miller 2014). The shift was caused by the tight labor pool. Companies are concerned about their labor costs, however some of these costs can be reduced by automation (Moss and Miller 2014). The only problem with increased automation is the need for more skilled labor. The challenge going forward for leaders and companies is to recruit potential employees that may not have all of the skills and to quickly train and prepare them for their position (Moss and Miller 2014).

In recent years, there has also been an increasing trend to use personality assessments in the pre-employment process. Stabile found that the use of personality assessments have grown into a $400 million-a-year industry (2002, p. 280). There are many options for employers to choose from when considering personality assessments. Companies use these assessments because of the cost of making a bad hire. Stabile writes, “According to one estimate, the average cost of replacing a bad hire is 1.5 times the worker’s salary and benefits, meaning that it could cost $45,000 to replace someone making $30,000 (2002, p. 283).” Company decision makers have to be careful when using these assessments though, as there is conflicting evidence about the validity of predictors (Stabile 2002, 290). In the conclusion of Stabile's paper, Personality Tests as a Hiring Tool, she writes, "in many cases, (personality tests) do not do what they are supposed to do (2002, p. 313)."

2.2 Technology and Big Data

Technology doesn't change the business environment by itself. It is the next generation of leaders and how they use technology that changes the environment (Chan 2013). The creation of the internet, social media, cloud storage, and smart phone have already made significant changes in the environment. But, what about the impact on businesses? In a 2013 article in *Forbes*, it was estimated that 90% of the world's data were created within the previous two years (Selinger 2013). The article also cites a recent study of 75 North American retail executives that found that 46% of retailers feel the biggest challenge facing them is the sheer volume of data (Selinger 2013).

The challenges manufacturing leaders face are not in generating data, but rather filtering, analyzing and having timely information. Decision makers need this data as close to real time as possible to maximize profitability or minimize a potential loss. There are many companies that are developing technologies to help manufacturing leaders deal with these challenges. One such company is IQity, is a leader in "Manufacturing in the cloud". Its cloud based system links together many different programs and components used in day-to-day operations.

The basis of the IQity system is to tie five areas of manufacturing into one output source. The five areas are Enterprise Resource Planning (ERP) data and information, Human inputs, Production inputs, Quality inputs, and Machine inputs (Starsenic 2014).

One of the highlights of the system is that it continually updates, giving the user up to the minute information. This information can be set-up in a customizable "dash-board" (Starsenic 2014). The data the system generates is stored within a cloud, therefore, decreasing required on-site data storage capacity. As discussed in other areas, time is one of the scarcest resources leaders have. Systems like the IQity increase efficiency and effectiveness of company leaders. The design of the new production line equipment allows a system, such as IQuity, to be integrated, easily.

2.3 Vibratory Conveying Technology

Why Vibratory conveyors over rollers? With growing concerns of food safety and sanitation within a food manufacturing facility, the cleaning ability and containment of product are high priorities. Although a larger initial pull of electricity is required to start vibratory style conveyors compared to belted conveyors, the required maintaining pull is nearly zero according to Meyer Machine Group (Harris 2014).

Vibratory conveyor methodology has been around for more than a century, but as McMillan noted in his research, the reluctance of industries to adopt the technology was driven by the absence of people in the work force with adequate knowledge and understanding of vibratory mechanics (2011). Mc Millan explains how educational institutions began to offer higher education opportunities surrounding vibratory mechanics (2011). Vibratory conveyors work by throwing product in a vertical and horizontal direction. This is done in rapid succession at a rate of multiple times per second, which has the ability to move a deep bed of product fairly quickly (McMillan 2011). The movement between lowest and highest points of the vibratory bed is called a stroke.

When researching the design of vibratory conveyors there are different styles of vibratory drives. Best Maid currently uses a conveyor made by Simplicity. This system uses a drive shaft mounted within the pan frame, which is also known as a brute force drive. Figure 2.1, shows the current machine. The points of failure are the shaft bearings and welds around the bearing that frame connection points. In talking with Meyer Machine Company, Harris noted that with this style there is a lot of vibration that will transfer into the substructure (the frame). This requires a higher amount of constant electricity to operate.

Figure 2.1: Simplicity Conveyor

There are two different styles of vibratory conveyors used in this purposed capital investment. The first is the VFII conveyor. Figure 2.2 shows a similar VFII Conveyor pan. The VFII uses a Dual Vibra Motor shown in Figure 2.3. This motor is directly attached to the pan (or bed). The motor is corrosion resistant, self-contained, and self-lubricated. One the easiest differences to pick up on are the springs located on the side of the pan. The number and spacing of the springs is part of the "tuning" process that Meyer does (Harris 2014). By tuning the pan, the amount of vibration absorbed into the frame can be reduced. Additionally, the springs are able to capture potential energy as well as expend kinetic energy each cycle, which reduces the amount of energy required to operate the system (Harris 2014).

Figure 2.2: VFII Conveyor

Figure 2.3: Dual Vibra-Motors

The second type of vibratory conveyor is a Centron Drive. Each filling station has one of these systems. The system is designed with much of the technology applied to the VFII Conveyor with one exception. To execute the flow and dribble effect to achieve more precise product weights, a Dual Vibra-motor would not work. The Centron Drive uses an electromagnet to create the vibration (Harris 2014). The electromagnet has the ability to more easily adjust speeds and tolerate the stop-start function that is required.

2.4 Increasing Productivity

Imberman recently published an article for the research group Area Development. He provides four ways to boost overall productivity: (1) boost employee productivity, (2) increase supervisory efficiency, (3) improve managerial effectiveness, and (4) invest in new labor-saving equipment (Imberman 2014).

One way of boosting productivity is to offer an incentive program. However, before implementing the incentive program; the current productivity of the employees must be measured (Imberman 2014). Within the food manufacturing industry, these productivity figures are represented by Key Process Indicators (KPI's). They vary from simple equations like sales dollars per labor hour spent, to complex ones like Overall Equipment Effectiveness and Overuse / Material Efficiency. However simple or complex the equation is, the most important part of this process relates to how easily the numbers are communicated to the workers (Imberman 2014).

Measuring supervisory efficiency is an overlooked area in many companies, mainly because it is difficult to measure and it is easier to blame workers than challenge tenured employees (Imberman 2014). Ineffective supervisors or poor supervisory efficiency can be created by a lack of goals. Goal-setting theory identifies two major characteristics of goals that together lead to improved levels of performance and motivation (George and Jones 2012, p. 202). The first is specificity; the other is difficulty (George and Jones 2012). Goals have to be specific in nature, such as improve efficiency by 8%, or even better, 8% on a specific item or group of items. Nearly everyone with little effort can achieve an easy goal. Difficult goals lead to higher motivation (George and Jones 2012). One other option managers may use is job crafting. Job crafting allows managers to proactively modify the tasks that comprise their supervisor's job, how they view their job, and who they interact with while performing their job (George and Jones 2012, p. 187).

Improving Managerial Effectiveness is difficult. The area most managers need to develop is time management (Imberman 2014). Imberman suggests that the first step towards improvement is to understand the goals and priorities of the leaders and also the functions of the identified manager (2014). The goal of understanding these functions is to delegate tasks that are simple, easy, or repetitive to subordinates.

The fourth way Imberman identifies to improve productivity is through capital investment (2014). He notes that the expected future results are often overestimated because of two reasons: first, because the decision maker is out-of-touch with the real problems, and second, leadership fails to involve employees at multiple levels (Imberman 2014). As leaders and decision makers of a mid-size company, what are the options, styles, and are there guidelines to follow? In the 1970s, Vroom and Yetton developed a model that describes different options and to what extent subordinates should be included in decision making (George and Jones 2012). The Vroom and Yetton Model identifies four decision making styles: Autocratic, Consultative, Group, and Delegated (George and Jones 2012, p. 352). The model asks the decision maker to consider a series of criteria the nature of the tasks, the level of task interdependence, the output produced, and the characteristics of the employees involved (George and Jones 2012, p. 352). Leaders that underestimate the importance of employee involvement or employee engagement are limiting the potential success of current and future ideas.

2.5 Literature Review Conclusions

The variety of topics covered within this section are wide. However, they all come back to basic goal of increasing the owners' wealth. Do good capital investments increase the wealth of the owners? Yes, but they are only one piece of the puzzle, when looking at the long term success of the company. The topics covered in the literature review are a road map to establishing a long term plan to continually increase the wealth of owners. Section 2.3 discuss new technological opportunities that are included in this purposed capital investment. Sections 2.1, 2.2, and 2.4 all have connections back to people. People are the life blood of a company. Without people, there is no company.

CHAPTER III: THEORECTICAL MODEL

3.1 Background Information

The business environment has changed over the years. Increasing emphasis has been placed on performance driving profitability. Companies are looking inwards and strategizing on how to create competitive advantage over organizations in their industry. In many cases, capital expenditures are needed to achieve the needs of the company today and into the future. Capital expenditures can target areas such as production speed increases, headcount reductions, elimination of waste, or a variety of other factors that impact the profitability and sustainability of the company. Capital expenditures are risky in nature and can impact the livelihood of a company. Individuals responsible for evaluating capital projects must ensure the accuracy of the numbers within the project analysis. Additionally, it is the responsibility of the project's presenter to ensure that all decision makers fully understand the methods used to analyze a project.

3.2 Net Present Value

Net Present Value (NPV) is one technique used in the evaluation of investment projects. This tool looks at the net contribution a project makes to the overall wealth of the owners or shareholders. NPV can be useful in decision making when owners are faced with multiple investment options but have limited funds available at the current time. This dilemma is known as capital rationing. Decision makers dealing with capital rationing should approve the combination of investment opportunities that yields the highest total NPV. The difference between the present value of cash inflows minus the present value of cash outflows for the life of the project is the projected net present value. Companies should only consider projects with a positive NPV and reject those with negative NPVs (Brealey, Myers and Allen 2008).

Profits can be dispersed two ways, as dividends to the company's shareholders or owners or reinvested back into the company. Net present value gives owners three distinct advantages when considering investment options. First, net present value compares the projected cash flows to the opportunity cost of capital. The forfeit of expected returns in favor of investing in capital is the opportunity cost. Within the NPV calculation, the opportunity cost is considered by using the discount rate. NPV assumes that a dollar invested today is worth more than a dollar tomorrow because the invested dollar will have earned interest. Another advantage of NPV is that it calculates the value of the project in "today's" value of a dollar. This allows decision makers to more clearly and equally evaluate multiple projects at the same time (Brealey, Myers and Allen 2008).

3.3 Other Common Techniques

Other common techniques used to evaluate investment projects are the payback rule, book rate of return, the internal rate of return (IRR), partial budgeting and owner's choice. The payback rule looks at the time it takes the discounted cash flow to recoup the initial investment. Using this rule can give decision makers misleading results, because cash flows throughout the remainder of the life of the equipment are ignored. Decision makers run the risk of rejecting profitable long-term projects or accepting poorly performing short-term projects (Brealey, Myers and Allen 2008).

The book rate of return is equal to the book income divided by the book assets. This can cause confusion because of differing accounting practices. Companies classify expenditures as operating costs or capital investments. Operating costs are deducted from the income for that year. Capital expenditures are added to the balance sheets and have the value depreciated over time. Every year the depreciated amount is deducted from the income for that year. The main reason for not using this tool is that the book rate of return is dependent on what is classified as capital expenditures and the depreciation schedule of assets.

The internal rate of return (IRR) is calculated by setting NPV to 0 and solving for the break-even discount rate. There are some precautions that need to be considered when using IRR. IRR can be difficult to interpret when considering lending or borrowing, factoring multiple rates of return, choosing between mutually exclusive projects, or assuming there are not differences in interest rates for short-term and long-term projects.

Partial budgeting is a tool often used in the agricultural industries. A partial budgeting is broken up into two sections: positives and negatives. Positive benefits include items that will either increase income or reduce/elimination cost. Negative impacts would be items that increase cost or reduce income (Tigner 2006). If the net impact (positives minus negatives) yields a positive value, the idea should be implemented (Tigner 2006). The limitation of partial budgeting is that ignores the time value of money (Dairynz n.d.). Since the expected life of the equipment is 20 years, if this tool was used, the expected return would be overstated. Partial budgeting is a useful tool for evaluating projects with a one or two-year life expectancy.

Owner's choice is a decision, right or wrong made by the owner(s). Additional attempts to persuade or change the decision of the owner could result in a permanent vacation. Reasons for these decisions can range from past experiences, inside information, personal preference or "just because."

CHAPTER IV: METHODS AND RESULTS

The evaluation of this line replacement capital investment includes the calculations for net present value and the internal rate of return. The projected life of this project is 20 years.

4.1 Net Present Value Formula

The following formulas were used:

$$NPV = -C_0 + \sum_{t=1}^{N} \frac{C_t}{(1+r_t)^t}$$

NPV is The Net Present Value of the investment. C_0 is the initial investment required and includes demolition, training, installation, and equipment. C_t is operating cash flow at period *t*. The operating cash flow is the difference between the cash inflow and outflow for period *t*. r_t is the discount rate for period *t*. The rate used in the calculations was 10%. The index, *t* is the year of the project. N is the lifespan of the project (20 years).

4.2 Assumptions

When evaluating the project assumptions must be made. The accuracy of these assumptions is important.

4.2.1 Labor Assumptions

The investment will reduce labor requirements by 5 people. The positions eliminated would be the juicing operator, capping operator, bucket labeler, and two bucket cleaners. The labor savings assumption factors in the time that line would be running without the extra employees because the set-up and sanitation time requirement could vary with a reduced staff. Increases in wages are not planned or expected. The average line runs 51 hours per week. The analysis assumes that average line run will remain the same over the life of the project. Overtime is calculated at one and a half times the hourly wage for hours worked after exceeding 40 hours in one week. If an increase in wages were to occur during the projects lifespan, this would impact NPV in a positive way. Other compensation includes the employee's benefits package and other additional costs of employment. Labor savings are presented in Table 4.1.

Table 4.1: Labor Savings for the Redesigned Bucket Line

Annual Savings	
Five Full Time Employee	$ 87,568.00
Overtime	$ 36,121.80
Other Compensation	$ 24,737.96
Total Savings	$ 123,689.80

4.2.2 Scaling Assumptions

Over-scaling occurs when more product is put into the container than required. Assumptions were made regarding the average amount each variety is over-scaled. Over-scaling can be reduced from each bucket without being in violation of the National Institute of Standards and Technology's standards. The new lines filler controls prevent underweight buckets from proceeding down the line, but also the variable speed fillers will minimize the amount of over scale in each bucket. The analysis assumes that the price of the cucumbers is $0.28 per pound of pickles and will remain constant for the life of the equipment. This was calculated from the previous year's average price per bushel divided by 50 pounds. Another assumption used to calculate the over-scaling savings is that the sales volumes for the specified varieties remain the same. The analysis uses 2015 end of year sales numbers. Table 4.2 shows the value savings by variety.

Table 4.2: Over-Scaling Savings for the Redesigned Bucket Line

Variety	2015 Units Sold	Unit Overscale (lb)	Cucumbers ($/lb)	Give-away ($)
A	300,928	1	$ 0.28	$ 84,259.84
B	101,088	2.5	$ 0.28	$ 70,761.60
C	36,435	1.5	$ 0.28	$ 15,302.70
D	18,293	1.5	$ 0.28	$ 7,683.06
			Total	$ 178,007.20

4.2.3 Maintenance Assumptions

Working with the engineers at the Meyer Machine Company, the analysis includes projected maintenance related costs. Table 4.3 shows the projected cost of parts for each year. The schedule of costs is based upon Meyer Machine Company's experience and knowledge of the lifespan of specific parts for the equipment. To factor the future cost of the parts, a 2% inflation rate has been added to the scheduled costs. The Bureau of Labor Statistics released its' July 2014 Consumer Price Index Summary that indicated an overall 2% increase (Bureau of Labor Statistics 2014). History has shown that inflation rates change. By including the 2% inflation factor, the author is not projecting the inflation rate to remain at 2% during the lifespan of the project, but rather looking to project accurate estimates. Since this project is replacing equipment, the time required to maintain the new equipment is the same as the old. A decrease in the required time is possible, but would be difficult to project and calculate over the life of the equipment.

Table 4.3: Projected Maintenance Costs for the Bucket Line

Year	Projected Cost	Projected Cost with 2% Inflation
1	$ (8,000)	$ (8,160)
2	$ (8,000)	$ (8,323)
3	$ (8,000)	$ (8,490)
4	$ (8,000)	$ (8,659)
5	$ (8,000)	$ (8,833)
6	$ (8,000)	$ (9,009)
7	$ (8,000)	$ (9,189)
8	$ (8,000)	$ (9,373)
9	$ (8,000)	$ (9,561)
10	$ (8,000)	$ (9,752)
11	$ (8,000)	$ (9,947)
12	$ (8,000)	$ (10,146)
13	$ (8,000)	$ (10,349)
14	$ (8,000)	$ (10,556)
15	$ (8,000)	$ (10,767)
16	$ (8,000)	$ (10,982)
17	$ (8,000)	$ (11,202)
18	$ (8,000)	$ (11,426)
19	$ (8,000)	$ (11,654)
20	$ (8,000)	$ (11,888)
Totals	$ (160,000)	$ (198,267)

4.3 Capital Costs and Expenses

The design of the project was completed by Meyer Machine Company in San Antonio, Texas. Table 4.4 lists the cost of the equipment and projected costs associated with the shipping, installation, and wiring along with a contingency amount.

Table 4.4: Capital Costs and Expenses for the Bucket Pickle Line

Meyer Supplied Components: Description	2015 Updated Price Estimates (per unit)	Qty Needed	Extended Prices
HPB-36 Belt Conveyor - Elevating belt for raising slicer	$22,368.00	1	$22,368
VFII-25-8 Distribution Vibratory Conveyor for loading weigh heads	$63,065.00	1	$63,065
SDF-18 Weigh Head Station (Includes bucket positioning and brine filling components)	$70,089.00	4	$280,356
HPB-12 Belt Conveyor - Manually loaded with empty, clean buckets, allow mounting of automatic label placer	$18,062.00	1	$18,062
HPB-12 Belt Conveyor - Indexes and sets empty buckets in weighing heads	$19,578.00	1	$19,578
HPB-12 Belt Conveyor - Collects filled buckets, transports them to automatic lidder	$19,269.00	1	$19,269
HPB-12 Belt Conveyor - Receives lidded buckets, allows mounting of washing station components	$17,156.00	1	$17,156
Bucket Washing Module - Custom - Adds covers, sprays bars, and air knives to rinse off exterior brine	$10,471.00	1	$10,471
Bucket Index Mechanism - Custom - Traps bucket in place on various belt conveyors	$683.00	6	$4,098
Control Panel - Free standing panel to control/automate system except for required manual inversion points	$71,216.00	1	$71,216
Specialty system requires several custom engineered components	$21,000.00	1	$21,000
Spare Parts	$30,000.00	1	$30,000
Total			$576,639
Non-Meyer Supplied Components:			
Control GMC Automatic Lidding System	$56,250.00	1	$56,250
Automatic Labelling Applicator (can be mounted to bucket de-nesting conveyor)	$20,000.00	1	$20,000
Automatic Date / Serial Number etcher (uses ink, laser etcher may be possible)	$10,000.00	1	$10,000
Total			$86,250
Project Expenses			
Demolition			$0
Shipping			$12,000
Installation			$30,000
Wiring			$100,000
Spare Parts			$50,000
Contingency			$50,000
Total			$242,000
	Project Total		$904,889

4.4 Depreciation Schedule

The depreciation schedule used by the company is a straight-line five year. This assumes that at the end of year 5, the system has a salvage value of $0.00. Table 4.5 shows the depreciation schedule.

Table 4.5: Depreciation Schedule for the Bucket Pickle Line Investment

Initial Investment:	$ 662,889	
Years	Tax Depreciation Percentage	Dollar Amount
1	20%	$ 132,578
2	20%	$ 132,578
3	20%	$ 132,578
4	20%	$ 132,578
5	20%	$ 132,578
Total	100%	$ 662,890

4.5 Taxes

The company is classified as an S Corp. The “C” and “S” statuses of a corporation relate to its taxes (Wood 2012). S Corps and C Corps differ in a couple of areas; C Corps are double taxed on income and dividends. They also require a corporate hierarchy, but can have an unlimited number of owners/shareholders. S Corps act more like partnerships; the income of the company is reflected on each owner’s personal taxes and there are limitations on the number of owners/shareholders (Wood 2012). This is a benefit for the owners/shareholders in that if the business incurs a loss, they can claim the loss on their personal taxes. Therefore, personal information would be needed to calculate the impact of the investment on each owner’s personal taxes. For this reason, the analysis calculated the impact to the company not the individual owners by using the highest tax bracket percentage of 39.6%.

4.6 Cash Flows Calculations for NPV.

This project was evaluated using a discounted cash flow analysis. Table 4.6 details the cash flows calculating the net present value of the project. The analysis resulted in an NPV of $567,024. Since the resulting value is positive, the project is projected to increase the wealth of the owners/shareholders.

Table 4.6: Cash Flows for NPV Calculation for Bucket Pickle Line Investment

Year	Capital Investment	Cash Outflow	Cash Inflow	Taxes	Operating CF	Net CF	DCF	Cumulative DCF
0	($662,889)	($242,000)			($242,000)	($904,889)	($904,889)	($904,889)
1		($8,160)	$301,697	($119,472)	$174,065	$174,065	$158,241	($746,648)
2		($8,323)	$301,697	($119,472)	$173,902	$173,902	$143,720	($602,928)
3		($8,490)	$301,697	($119,472)	$173,735	$173,735	$130,530	($472,398)
4		($8,659)	$301,697	($119,472)	$173,566	$173,566	$118,548	($353,850)
5		($8,833)	$301,697	($119,472)	$173,392	$173,392	$107,663	($246,187)
6		($9,009)	$301,697	($119,472)	$173,216	$173,216	$97,776	($148,411)
7		($9,189)	$301,697	($119,472)	$173,036	$173,036	$88,795	($59,617)
8		($9,373)	$301,697	($119,472)	$172,852	$172,852	$80,637	$21,020
9		($9,561)	$301,697	($119,472)	$172,664	$172,664	$73,226	$94,246
10		($9,752)	$301,697	($119,472)	$172,473	$172,473	$66,496	$160,742
11		($9,947)	$301,697	($119,472)	$172,278	$172,278	$60,382	$221,125
12		($10,146)	$301,697	($119,472)	$172,079	$172,079	$54,830	$275,954
13		($10,349)	$301,697	($119,472)	$171,876	$171,876	$49,786	$325,741
14		($10,556)	$301,697	($119,472)	$171,669	$171,669	$45,206	$370,946
15		($10,767)	$301,697	($119,472)	$171,458	$171,458	$41,046	$411,992
16		($10,982)	$301,697	($119,472)	$171,243	$171,243	$37,267	$449,260
17		($11,202)	$301,697	($119,472)	$171,023	$171,023	$33,836	$483,096
18		($11,426)	$301,697	($119,472)	$170,799	$170,799	$30,720	$513,815
19		($11,654)	$301,697	($119,472)	$170,570	$170,570	$27,890	$541,705
20		($11,888)	$301,697	($119,472)	$170,337	$170,337	$25,320	$567,024
						NPV	$567,024	

4.7 Cash Flows Calculations for IRR.

To identify the projects internal rate of return (IRR), the analysis used the same data shown in Table 4.6 and used the IRR function in Excel. The IRR of the project is 18.5%. The cost of capital was 10%. Therefore, the investment is profitable.

CHAPTER V: SENSITIVITY ANALYSIS

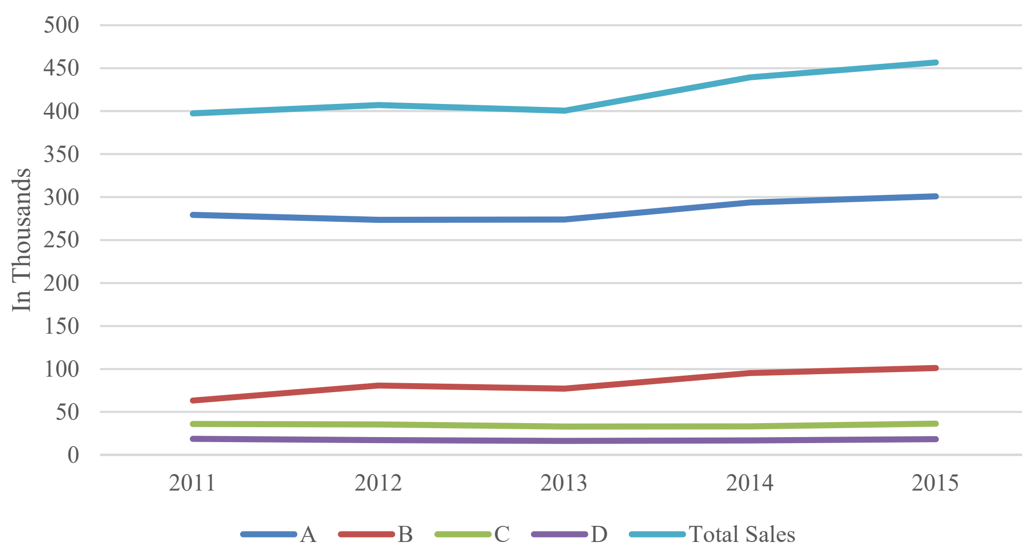
5.1 Sensitivity Analysis Objective

The NPV analysis completed in the previous chapter required many assumptions. While every effort is made to ensure the most accurate assumptions are made, what would the impact on NPV be if something changed? The objective of this chapter is to provide a sensitivity analysis to identify the effects of possible changes to the variables used to calculate the NPV. The sensitivity analysis will specifically look at the effects of changes made to two assumptions: sales volume and product sales remaining constant.

5.2 Sensitivity Analysis Change in Sales Volume

The NPV analysis in Chapter Four used the assumption that sales volumes of the specific items would remain constant for the life of the equipment (20 years). To better understand the sales volume history of these items, Figure 5.1 shows the sales volumes from 2011 to 2015.

Figure 5.1: Sales Volume by Year for Best Maid



The data shows a 4% overall growth of these items. Item B had the highest growth rate at 15.87%. Both items C and D show little to no growth and actually have very small negative growth rates of -0.36% and -0.67%. The highest volume item, item A, had a 2.39% yearly growth rate. The group of products shows growth each year with the exception of 2012 to 2013. This drop in volume is explained by a higher than normal price increase at the beginning of 2013. This price increase caused consumers to temporarily purchase other products. However, these customers soon returned in 2014 indicated by an increase of 39,000 units compared to 2013 and 32,300 more units than 2012.

Applying the overall group growth of 4% to the NPV analysis yielded an increase in NPV of $340,000. A secondary analysis was also completed using the individual items growth rate. The analysis returned an increase of over $1.2 million. This increase was mainly driven by the 15.87% growth rate of one item. While a sustained growth rate of 15.87% over the next 20 years is plausible, the difference between it and the other rates is significant and should be noted.

5.3 Sensitivity Analysis Change in Pickle Pricing

Cucumbers are a commodity. However, because of the nature of cucumber and their limited storage time, most cucumbers are produced with a contract in place prior to planting. As a result, the cucumber markets do not see wide swings in prices when compared to wheat or soybean markets. The sensitivity analysis was performed using multiple prices. Figure 5.2 identifies the price and corresponding NPV.

Figure 5.2: Effect of Changing Cucumber Price on NPV

Price*	$ 0.10	$ 0.22	$ 0.25	$ 0.28	$ 0.31	$ 0.34	$ 0.38
NPV	$ (21,400)	$370,900	$469,000	$567,000	$665,100	$762,200	$893,900

The analysis identified that the NPV would be positive down to a price of $0.10 per pound. While this price is of importance for the continuing operation of the company as well as the evaluation of this purposed project, the product used in the varieties analyzed in this project require a processed pickle. This means the $0.28 per pound of cucumbers used in the NPV calculation in the previous chapter is not the true actual price. The true real price of the over scaled pickles would be the price of the cucumbers plus the cost incurred by the company in turning that cucumber into a pickle. Unfortunately, current accounting practices prevent a more detailed number from being used.

CHAPTER 6: SUMMARY AND CONCLUSION

6.1 Summary of Results

The NPV analysis on replacing the existing pickle packaging equipment indicated a positive NPV value. The first sensitivity analysis was intended to look at past sales history of each item. However, as data was being collected on the growth rates it became apparent that one item was significantly growing at a much higher rate than the others. The analysis was completed using these numbers and returned a significantly higher NPV. A second sensitivity analysis was then completed using the combined growth rate of all four products. This also yielded a positive NPV. The last sensitivity analysis investigates the impact the cucumber price has on the NPV. Multiple prices were used and all returned positive values. Further analysis ultimately identified a price of $0.10 per pound of cucumber as the point when the NPV becomes negative.

6.2 Recommendation

Based upon the NPV of the pickle packaging equipment and the sensitivity analysis, the owners of Best Maid Products should consider adopting the new technology. As with any product, there will be associated risks that coincide. The most likely of risks is that the sales volume of this product decreases. Cucumber prices are unlikely to decrease by 64% nor is it likely that employees would express interest in lowering their wages.

However, to compensate for some of the unknown risks some potential additional savings are excluded. These include possible opportunities to increase production speeds, impacts of increased efficiency, and the cost associated with using a processed pickle versus a fresh cucumber.

6.3 Future Projects

Future studies will focus of the completion of a 10-year plan that would include additional components being added to this analysis. These projects include opportunities such as line relocation and conveying projects.

REFERENCES

Brealey, Myers, and Allen. 2008. *Principles of Corporate Finance.* McGraw Hill.

Bureau of Labor Statistics. 2014. "Consumer Price Index Summary." *United States Department of Labor.* August 19. Accessed August 19, 2014. http://www.bls.gov/news.release/cpi.nr0.htm.

Chan, David. 2013. "The World is Turning Upside Down." *Cass Business School.* November 19. Accessed September 23, 2014. http://www.cassknowledge.com/research/article/challenges-facing-management-rapidly-changing-business-environment.

Dairynz. n.d. *Dairynz.* Accessed July 13, 2016. http://www.dairynz.co.nz/farm/financial/budgets/partial-budgeting/.

Dalton, Brian, interview by Chris Witt. 2013. *President of Best Maid Products* (January).

George, M Jennifer, and R Gareth Jones. 2012. *Understanding and Managing Organizational Behavior.* Upper Saddle River: Prentice Hall.

Harris, Adam, interview by Chris Witt. 2014. *Meyer Machine Regional Sales Manager* (September 17).

Imberman, Woodruff. 2014. "Stepping Up Your Game Through Productivity Improvement." *Area Development.* Quarter 2. Accessed September 23, 2014. http://www.areadevelopment.com/laborEducation/Q2-2014/SME-suppliers-productivity-improvement-Imberman-2982.shtml.

McMillan Jr, Gregory J. 2011. "Analysis of Vibratory Equipment Using the Finite Element Method." *University of Wisconsin Stout.* May. Accessed September 17, 2014. http://www2.uwstout.edu/content/lib/thesis/2011/2011mcmillang.pdf.

Moss, Don, and Grant Miller. 2014. "Corporate Executive Survey Commentary: Labor Costs No Longer Paramount." *Area Development.* Quarter 1. Accessed September 23, 2014. http://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2014/corporate-exec-survey-analysis-Moss-Miller-Colliers-7118441.shtml.

Selinger, David. 2013. "Big Data: Getting Ready For The 2013 Big Bang." *Forbes.com.* January 15. Accessed September 24, 2014. http://www.forbes.com/sites/ciocentral/2013/01/15/big-data-get-ready-for-the-2013-big-bang/.

Stabile, Susan J. 2002. "The Use of Personality Tests as a Hiring Tool: Is The Benefit Worth The Cost?" *University of Pennsylvania Journal of Labor and Employment Law* p279-p313.

Starsenic, Ken, interview by Chris Witt. 2014. *Sales* (September 25).

Tigner, Robert. 2006. *Nebraska Extension Educator.* May. Accessed July 13, 2016. https://www.extension.iastate.edu/agdm/wholefarm/html/c1-50.html.

Wood, Robert W. 2012. "C or S Corporation Choice is Critical for Small Business." *Forbes.com.* May 3. Accessed August 19, 2014. http://www.forbes.com/sites/robertwood/2012/05/03/c-or-s-corporation-choice-is-critical-for-small-business/.