IPRO 321: Final Report

KnowIITAles

Faculty Advisor: Dr. Vijay Ramani

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Business Plan

1. Executive Summary

Beer is believed to be one of the oldest drinks in the world. It has been proposed that beer was discovered when humans stopped being hunter-gatherers and instead chose to live a more settled lifestyle. The first beers, beverages derived from barley and wheat quickly became the staple beverage of the earliest civilizations. Beer consumption is believed to have been widespread as early as 4000 BC throughout the fertile crescent before writing existed. Because of this, the discovery of beer and how it occurred is pure speculation. It is believed that stored grains, in times of food shortages, would be heated in water to make gruels that could provide the calories necessary to survive. It was only a matter of time until one of these containers was be stored for too long and begin fermenting; when this liquid was tasted again, it is believed that physiological effects were noticed. Another value that beer provided was that it remained safe to drink for very long periods, and would resist infestation by insects. This was an important quality in these times, and beers became valuable products that could be traded for goods. These early beers were thick drinks, with debris that would gather at the surface, as a result, a straw had to be used to drink.

Beer is one of the most consumed beverages in the world. The concept of brewing beer is one that continues to attract the attention of people from all walks of life. Beers can be differentiated one from another in terms of their color, alcohol content, smoothness, bitterness, the type of ingredients used as well as the recipe used. In a very broad sense, however, beer can be broken up into lagers and ales. The main difference between lagers and ales is the kind of yeast used and the conditions under which the fermentation is carried out.

A lager is brewed at a low temperature with lager yeast while ales are brewed at room temperature with ale yeast. IPRO 321, KnowIITAles, attempted to produce a beer that is on the continuum between lagers and ales: the German Altbier. The Altbier has a unique combination of flavor, aroma, bitterness and smoothness. The main goal of the members of KnowIITAles was to combine previously theoretical chemical engineering concepts with a real life problem: the creation of an altbier. This required precise control over the temperature of the fermenting beer to produce the distinctive flavors of the final product.

In order to understand the physical processes of the fermentation, kinetics data was collected and compared to cell growth models with substrate inhibition. It was found that each batch of beer was governed by different kinetics due to the differences between the temperatures and compositions. Another aspect that was studied in greater detail was the thermodynamic properties of the cooling system employed in the production of the altbier. Through this study, potential improvements were identified and could be implemented in future iterations of the project.

A special team was assembled to assess the feasibility of and create a business plan for the future scenario where KnowIITAles could mass produce its beers and sell them through the Bog for a profit. The financial summary and project budget is presented in the appendix.

2. Team Purpose

IPRO 321 is a group of students brought together through a common interest in zymurgy; we look to gain practical and professional experience in experiments and scale-up design, academic research, and project management. The students of IPRO 321 also shared a desire to gain experience with formulating a business plan for a start-up company to see it carried on in future semesters.

3. Objectives

a) To gain a working understanding of zymurgy
b) To design a suitable brewing process
c) To produce a quality product
d) To perform an economic analysis of our brewing process
e) To apply the concepts of chemical engineering to creating a quality beer
f) Compare existing home brewing setups and try to improve upon them
g) Cooperate in working towards common goals while maintaining academic and behavioral integrity
h) To create a feasible business plan to run a microbrewery
i) To gain an understanding of the regulations regarding beer brewing

4. Organization and Approach

To address the multifaceted problem of designing a brewing process and creating a business plan, our team was split up into sub teams specializing in brewing, marketing, and quality control. These teams were each headed up by a sub group leader who coordinated the efforts of the sub team while communicating with our team leader to report on the progress made toward individual goals.

4.1. Brewing

4.1.1. Brewing Days

In order to best accommodate the numerous team members, it was necessary to appropriate two days to the brewing process to ensure that as many people as possible would get hands on experience. The first day was a Sunday at 1:30 and the team was composed of

Abadalmohsen Alhassan
Graham Johnson
Heta Panchal
Jaya Singh
Jordan Llarenas
Keller George
Raksha Rajaopalan
Ryan Kyle
StephanieLucas
Tobiah Isbell
Whitney Horn

The second day was a Monday at 3:00 PM and the team was composed of

Amjed Husein
Andre Colmenares
Andrew Raddatz
Bonnie Au
Faisal Alanzi
Kamaldeen Olorunoje
Mike Krolikiewicz
Minsung Choi
Paul Adamcyk
Sam Amelio
Sami Sono
Stephanie Lucas

4.1.2. Brewing Team

The brew team was responsible for determining the equipment needed for the actual brewing of the beer as well as the creation of the recipes that would be used later in the semester. They performed the calculations to size the equipment to the batches that the team would be producing. The team used surveys to determine the popular opinion on beers and used that to formulate the recipes for the team.

The Brewing Team was composed of:

Sami Somo
Bonnie Au
Paul Adamcyk
Jaya Singh
Kolade Adebowale
Minsung Choi
Graham Johnson
Andre Colmenares
Kamaldeen Olorunoje
Keller George
Ryan Kyle

4.2. Marketing

The Marketing team was formed with the purpose of making our beer marketable. Later in the semester though, this expanded to include the business aspect of the project in the form of the business plan. The marketing team was also responsible for all graphics related to the project including logos and labels for our beer bottles.

The Marketing Team was composed of:

Amjed Husein
Tobiah Isbell
Michael Krolikiewics
Jordan Llarenas
Stephanie Lucas
Heta Panchal
Kamaldeen Olorunoje
Keller George

4.3. Quality Control

The importance of Quality Control (QC) to this project cannot be overemphasized. All the ingredients used as well as the equipment and the brewing conditions have to be carried out under very clean and hygienic conditions. For instance, the pH of the water used had to be checked to make sure it was within an acceptable range. The mineral content was also important in order to make sure that it did not have excessive amounts of unwanted minerals. Furthermore, all the equipment used was sterilized and gloves were worn all the time in order to avoid contamination of the ingredients and product.

The Quality Control Team was composed of:

Faisal Alanazi
Alhassan Albdalmohsen
Sam Amelio
Whitney Horn
Andrew Raddatz
Raksha Rajagopalan
Nicholas Shattuck
Andre Colmenares

4.4. Sub Teams

Once the team realized that there were specialized tasks that needed doing, these teams further subdivided into smaller groups. These groups were subsets of the three larger groups and drew their people

4.4.1. Legal

The legal team reported its findings to the marketing team and was concerned with investigating the process involved with selling an alcoholic beverage brewed by KnowIITAles, specifically the licensing and registration in the state of Illinois.

4.4.2. Kinetics

The kinetics team reported its findings to the Quality Control team and was responsible for determining the correlation between the theoretical models and the data collected. This was done through MATLAB analysis of the data and referencing the Chemical Reaction Engineering book.

4.4.3. Thermodynamics

The thermodynamics team reported its findings to the Quality Control team and was responsible for determining the heating and cooling load during the boiling and chilling of the wort. This was done by using MATLAB and the thermodynamics book.

4.4.4. Recipes

The recipe team reported its findings to the brewing team and was responsible for determining what beers would be brewed to best suit the tastes of the IIT student body. This was accomplished through administering surveys via Google forms asking questions about the qualities students look for in their beers.

4.4.5. Logo

The logo team worked under the Marketing team was concerned with creating the labels for the beers as well as the logos for the team. After conceptual designs were voted upon, finalized versions of all graphics were created for use in all KnowIITAles products.

4.4.6. Business Plan

The Business Plan team worked under the Marketing team and was responsible for devising a feasible business plan for a microbrewery and monitoring the budget for the IPRO.

4.4.7. Brochure/Poster

The brochure/poster team worked under the Marketing team and was responsible for producing the poster and brochures for IPRO day. To do this, it was necessary to collect all of the information from the other groups who were performing many different tasks and present it in a quickly understandable fashion.

5. Analysis and Findings

5.1. Brewing

Our team made three distinctly different beers. The first batch was an altbier. An altbier is a beer that is brewed between 50-65 °F. Our team designed and created a temperature control system that worked very well, keeping the altbier at a constant temperature of 50 °F during both primary and secondary fermentation. This beer had a light, full flavor and had an alcohol content of around 5.5% alcohol by volume. This was dubbed “Light Sweet Crude.”

Our second beer followed the same recipe as the first one, but was brewed at room temperature (approximately 70 °F) This was done to form a basis of comparison of kinetic data from the altbier process to the ale process. This beer finished primary fermentation very quickly because the yeast ideal temperature was 55 °F. This beer initially was thought to be an undesirable batch, but taste testing at the end of the process found it to be rather desirable by to those who like high quality beer. This beer is a dark beer with a strong hops presence, so it was dubbed “Bitumen.” It also contained the most alcohol, at 7.3% alcohol by volume.

Our third batch was made with a different recipe due to the fact that our group believed that the second batch was not desirable. This beer was also made with ale yeast and was brewed at room temperature. Its alcohol content was in the middle, at around 6% alcohol by volume. It had a heavier taste to it than the altbier, but was not as dark as the second batch, so it was dubbed “Crude” by our team.

5.2. Marketing

The business/marketing team was responsible for the analysis of a potential market for our beer at the IIT Bog. Said team acquired data from the Bog on the price, brand and number of purchases of different brands of beer from the bar. It was found that the most popular beer(by number of purchases) was Bud Light draft pitchers, priced at $5.50. This product was judged to be the main competition. After the analysis of start-up costs, the price for our product, called “Black Gold,” was set from $1.75-$2.25 for an 11 fluid oz. bottle. Furthermore, as the brewers become more experienced, the quality of the product will increase, thus making our product a great buy for IIT students and faculty who are able and wish to purchase beer from the Bog. It

was also discovered that the point at which the company breaks even comes sometime around October 2011 at this price.

5.3. Quality Control

5.3.1. Cellular Kinetics

The changes that occur during fermentation are changes in the sugar, alcohol, and yeast cell concentration within the carboy. These changes can be modeled with an equation developed by Jacques Lucien Monod which effectively describes current alcohol production as a fraction of the maximum production. The reason there is a fractional component is because there is an alcohol concentration at which the yeast cells are killed and production stops.

Unfortunately, these differential equations are interdependent and are therefore impossible to solve analytically. To properly model this phenomena, it is necessary to utilize MATLAB's built in ordinary differential equation solver with the proper inputs. When the kinetic models are compared to the data that was collected over the course of fermentation, there is a high level of agreement among the two.

5.3.2. Thermodynamics

The heat transferred from the boiling wort to the cooling water was analyzed using simple thermodynamic relationships learned in our thermodynamics class. Because of the small range of temperatures, we were able to simplify these equations further by assuming constant heat capacity of the cooling water. Nothing that would be unexpected happened during the cooling process and all of the heat “lost” simply went into heating the air in the room because the process was not adiabatic.

6. Conclusions and Recommendations

Overall, this was a very successful IPRO experience for all the people involved in it. Breaking the IPRO down into three smaller groups from our initial size of 70+ people was a major part in allowing individuals to feel involved in the project. In the future, we recommend that there are multiple Chemical Engineering Projects, or a more complicated project that requires application of Chemical Engineering topics as opposed to an opt in version like this IPRO was.

6.1. Brewing

The main obstacle that the brewing team had to work with was the acquisition of brewing equipment. Due to a series of setbacks, nothing was acquired until the middle of march, which means that for two and a half months the teams could not progress past the recipe selection stage. Despite the fact that this was beyond the control of the team, it resulted in an exceptionally low review at the midterm presentation. We therefore recommend that the purchase process be accelerated for future teams so that they can brew multiple times and perfect their recipes as well as have more for potential distribution on IPRO day as well as in the BOG.

6.2. Marketing

In our IPRO, our business plan only took into account the population of students at IIT as our potential customer, as well as the fact that our equipment and brewing style was meant for personal or small group consumption rather than mass production. A suggestion for future zymurgy IPROs would be the progression from homebrew production to microbrew production to macrobrew production. This would mean having to create a scale-up process for mass production of beer. The actual beer that is made during the IPRO would have to be produced in the same way that our beer was produced due to liquor laws. Further research could go into the type of beer and the target audience for the beer. For example, does the beer company choose to market to a general audience who drinks alcohol for social purposes? Do they want to market toward the so called "beer drinkers" who drink beer for the taste? Each beer would need to be made differently. These are some ideas for future consideration.

6.3. Quality Control

The kinetic and heat transfer data were collected and analyzed for different batches of beer. Further investigation into the kinetics of fermentation would be a good extension of this IPRO. What is necessary, however, is to brew the same beer recipe with the same yeast strain and the same conditions of brewing so that the kinetic data could be reproducible over multiple IPRO sessions. This could be a good project to learn how the kinetics work and could produce better quality beer and the alcohol content could possibly be controlled via the knowledge of the yeast behavior.

7. Appendix

7.1. Bibliography

Fogler, H. S. (2006). *Elements of Chemical Reaction Engineering* (4th ed.). Westford, Massachusetts: Pearson Education, Inc.

Seborg, D. E., Edgar, T. F., & Mellichamp, D. A. (2003). *Process Dynamics and Control* (2nd ed.). New York: John Wiley & Sons, Inc.

Smith, J. M., Ness, H. C., & Abbot, M. M. (2005). *Introduction to Chemical Engineering Thermodynamics.* Boston: McGraw-Hill.

IPRO 321 would also like to thank the following people for their guidance and advice throughout the semester:

Dr. Teymour
Dr. Abbasian
Dr. Ramani

7.2. Recipes

7.2.1. BATCH 1 & 2

Recipes: St. Udleys Beer
Ingredients:
6-lbs plain dark malt (15)
1-lbs German vienna grain
1-Ibs Belgian caramunich
(cara 45) grain
1-Ibs caramel 40 L grain
1oz perle (90)
0.5oz perle (40)
0.5 oz perle (15)
wyeast 2565 kolsch yeast
Irish mach(1-Ib)

7.2.2. BATCH 3

Recipes: St. Udleys Beer
Ingredients:
6 Lbs. Munton's Plain dark molt extract
color EBC 60
1 Lb German Vienna grain
1 Lbs Carmel 40 grain
2 Lbs Belgian cara 45 grain
1 oz Tentnag hop
1 oz perle (90) hops
0.5 oz perle (45) hops
6 Lbs dark malt
1 tbsp Irish moss
Wyeast American Ale XL yeast

7.3. Kinetics

These changes mainly include the changes in the sugar concentration, alcohol concentration and yeast cell concentration. In order to describe these changes, the system should be modeled. Modeling involves translating the physical phenomena into mathematical equations. Here is an example of a simple equation that can be used to represent our system:

$$Cells + Substrate \rightarrow More\ cells + Alcohol \quad (1)$$

The formation of more cells in the above equation can be described with a rate of growth equation. Famous scientist Jacques Lucien Monod, who had done a lot of research in the field of cell biology, described this rate as:

$$r_g = \mu C_c \quad (2)$$

Equation 2 is also known as the Monod equation. C_c represents the concentration of the cell in the system and μ stands for the specific cell growth rate and is expressed as:

$$\mu = \frac{\mu_{max} C_s}{(K_s + C_s)} \quad (3)$$

In equation 3, μ_{max} is the maximum specific growth rate, C_s is the concentration of the substrate and K_s is the Monod constant. The value or the μ_{max} and K_s depend on the type of the yeast used in the fermentation process and are obtained experimentally.

The rate of growth of the yeast cells, described by equations 2 and 3, can be modified further to include the fact that there is product inhibition in the system. Product inhibition means that the increasing concentration of the alcohol in the system starts killing the yeast cells which will in turn affect the fermentation process. So, there is a maximum threshold on the amount of alcohol that can be produced. The rate of growth equation, after accounting for the product inhibition, is as follows:

$$r_g = (1 - \frac{C_P}{C_P^*})^n \mu_{max} \frac{C_S C_c}{K_S + C_S} \quad (4)$$

C_P is the concentration of the alcohol. C_P^* is the product(alcohol) concentration at which the metabolism of the yeast cells ceases. n is an empirical constant.

Similarly, the rate of death of cells is expressed as:

$$r_d = k_d C_c \quad (5)$$

k_d is the cell death constant.

Using the principles of chemical reaction engineering and performing mass balances on the cells, substrate and the product gives us the following three systems of differential equations.

$$\frac{dC_C}{dt} = (1 - \frac{C_P}{C_P^*})^n \mu_{max} \frac{C_S}{K_S + C_S} - k_d C_c \quad (6)$$

$$\frac{dC_S}{dt} = -Y_{S/C} * (1 - \frac{C_P}{C_P^*})^n * \mu_{max} \frac{C_S}{K_S + C_S} - mC_C \quad (7)$$

$$\frac{dC_P}{dt} = Y_{P/C} * (1 - \frac{C_P}{C_P^*})^n * \mu_{max} \frac{C_S}{K_S + C_S} \quad (8)$$

In equations 6, 7, and 8:

μ_{max} = maximum specific growth rate
Ks = Monod Constant (g/ml)
Cc = concentration of cell (g/ml)
Cs = concentration of substrate (g/ml)
Cp = concentration of product (g/ml)
C_P^* = product concentration at which cells die and metabolism ceases
$Y_{S/C}$ = substrate to cell yield coefficient
$Y_{P/C}$ = product to cell yield coefficient
$Y_{P/S}$ = product to substrate yield coefficient
m = cell maintenance constant
n = empirical constant for cell concentration profile

Equations 6, 7 and 8 are three interdependent equations which describe the rate of change of cell concentration, sugar concentration and product concentration over time. These systems of differential equations can be solved using numerical solving methods. Different mathematical software have the capability of solving these equations. We used the ODE45 solver function in MATLAB® to solve the equations using the constants presented below and obtained the following profiles – cell concentration versus time, sugar concentration versus time, and product (alcohol concentration versus time).

μ_{max} = 1.44 day^{-1}
Ks = 0.0017 g/mL
Cc(0) = 0.00042 g/mL
Cs(0) = 0.1807 g/mL
Cp(0) = 0 g/mL
C_P* = 0.069 g/mL
$Y_{S/C}$ = 9.5238 grams of substrate/gram of cell
$Y_{P/C}$ = 5.0 grams of product/gram of cell
$Y_{P/S}$ = 0.525 grams of product/gram of substrate
m = 0.048 g substrate/(g cells*day)
n = 0.52
k_d = 0.12 day^{-1}

These values were obtained from various literatures and modified to match our model with the experimental data.

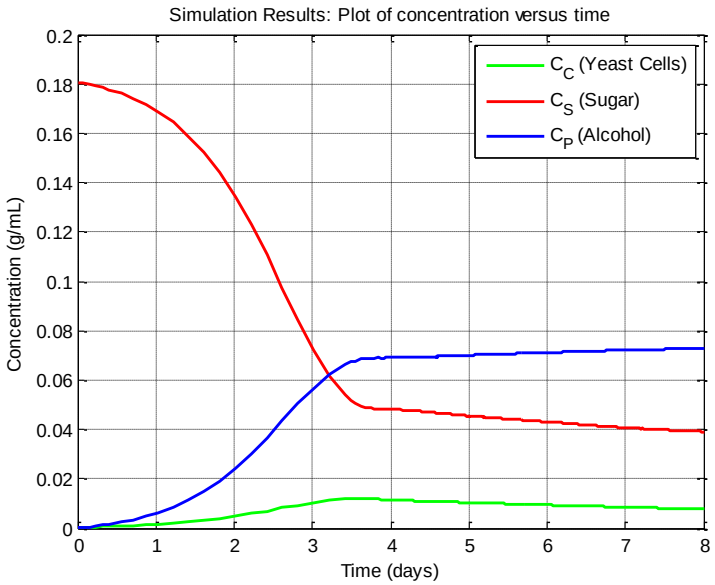

Figure 1.0 Concentration Profiles versus time

The concentration profiles obtained from the model were plotted along with the experimental data to check for the resemblances. The superimposed plot is as follows:

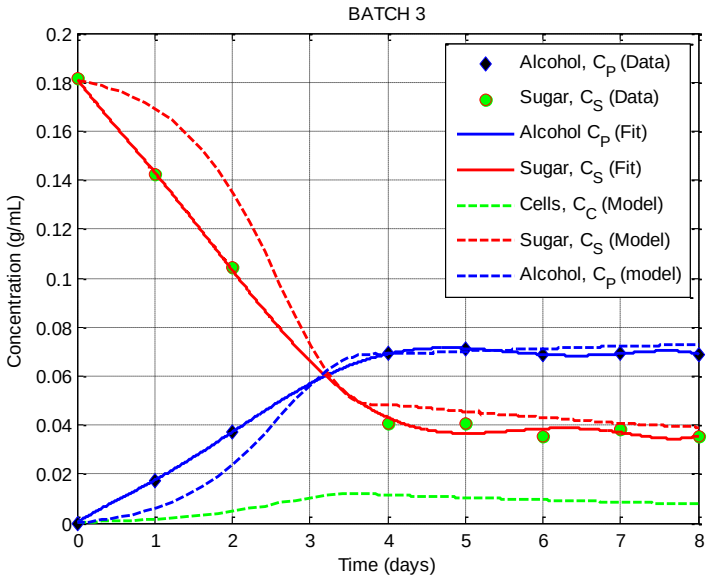

Figure 2.0 Experimental Data plotted along with the model.

As we can see in Figure 2.0 that the concentration profiles obtained from the model match up closely with the experimental data. We can also see that the model concentration profiles and the experimental data diverge a little bit in the beginning. This could be because of various factors which were not considered during the modeling phase or the experimental data might have some experimental errors. Nonetheless, models are not 100% accurate. They can only be used with some uncertainty. But, overall, we were able to model a batch fermentation process. The application of the modeling process could be the following:

Predict the time required for complete fermentation.

Predict the final concentration of sugar, alcohol and yeast cells in the product under different initial conditions.

Increase the performance of the brewing process by selecting optimal conditions that can be decided upon quickly from the model.

7.4. Team Members

Paul Adamcyk
Kolade Adebowale
Faisal Alanzi
Abdalmohsen Alhassan
Sam Amelio
Bonnie Au
Minsung Choi
Andre Colmenares
Keller George
Whitney Horn
Amjed Husein
Tobiah Isbell
Grahm Johnson
Michael Krolikiewicz
Ryan Kyle
Jordan Llarenas
Stephanie Lucas
Kamaldeen Olorunoje
Heta Panchal
Andrew Raddatz
Raksha Rajagopalan
Ricardo Rodriguez
Nicholas Shattuck
Jaya Singh
Sami Somo

IPRO 321: Business Plan

KnowIITAles

Faculty Advisor: Dr. Vijay Ramani

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1. Executive Summary

The Know IIT Ales will be producing high-quality, inexpensive micro-brew beer for the Illinois Institute of Technology population. The production will occur on campus and will be distributed to the campus food establishments. Our Black Gold beers currently include Light Sweet Crude, Crude and Bitumen which cover a range of tastes from light to potent. The beers will be developed further as business proceeds.

The target market consists of Illinois Institute of Technology students, faculty and visitors. The low price of the beer and high quality will attract these people. The market has great potential to allow our business to thrive.

The leadership of the business consists of Dr. Vijay Ramani Board President, Ricardo Rodriguez Chief Executive Officer, Andre Colmenares Chief Marketing Officer, Kolade Adebolawe Chief Technology Officer, Jaya Singh Chief Operations Officer and Faisal Alanazi Chief Financial Officer. This talented team will work toward building a strong business and providing a desirable product for IIT.

This strong business plan will provide continuity between the leadership provided by the future students who will control the business. The quick break-even point is a great motivation to move forward with this plan. The Know IIT Ales has great potential to provide a future famous product for IIT.

2. Business Overview

College students are notoriously stingy with their money, especially when it comes to beer (and alcohol in general). Unfortunately for them, quality and value are not things that are usually associated together with good beer. To remedy this problem, Know IIT Ales will strive to provide students at Illinois Institute of Technology with superior beer at affordable prices, made for students, by students.

The Illinois Institute of Technology has a campus bar and grill affectionately known as "The BOG," a reference to the early days of the school when the ground that Hermann Hall (where the BOG is located) is located on was used as a retention pond. Thursday and Friday nights when The BOG is open, it is common for groups of students to buy pitchers of beer to consume as they enjoy an evening of relaxation. What could be better? However, their choices in both price and selection are limited by what the bar carries. The cheapest pitchers are Budweiser, priced at $5.50, and Goose Island 312, priced at $7.50; the others are more expensive. Drafts and bottles are priced similarly. Common sense says that, as is proved by the numbers (Fig. 1), students consume Budweiser drafts and pitchers far more than they consume drafts, bottles or pitchers of any other beer. We aim to give students better choices for their money because who really wants to drink Budweiser all the time? Students should not be limited in their choices based on the price.

Know IIT Ales will brew beer at the university and offer its product at The BOG through an agreement with campus foodservice. As a group of students working for the benefit of ourselves and other students, we will be able to virtually eliminate overhead and operate as close to the break-even point as possible, making just enough to cover our costs. Since we will be brewing small batches on campus, we will be able to provide beer as needed in a timely fashion and adapt to the preferences of students by brewing a wide selection of beers. To make allowance for departing and graduating students, we will have a solid, comprehensive plan detailing all aspects of the business, allowing new students to continue business seamlessly from semester to semester, including summers, without any hiccups.

The vision after 2 years is quite simple. Know IIT Ales' brewing processes will be streamlined and reliable, and its beer will be known to students, faculty and staff as the best available on campus, benefiting The BOG with more customers and larger profits. We want to better the condition of the IIT student body by making it easier for students to enjoy a great selection of beers in a cost-effective manner. Happier students result in a better university.

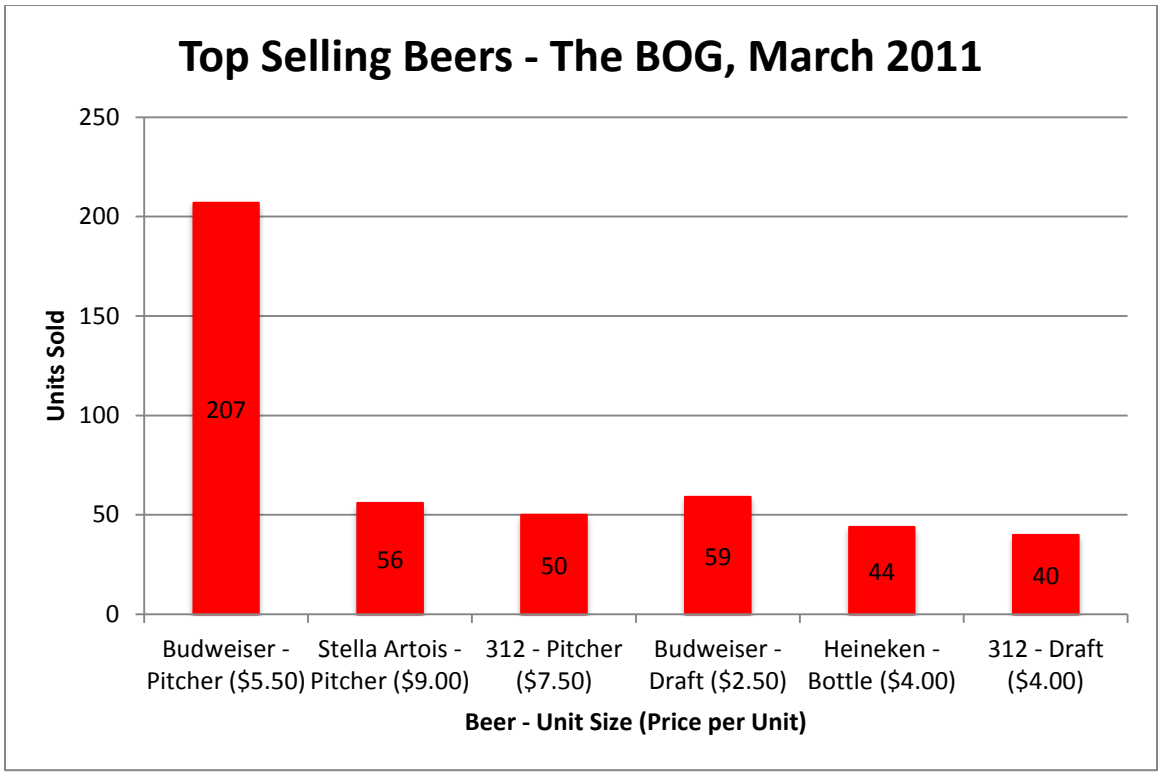


Figure 1:Top Selling Beers

3. Organization Description

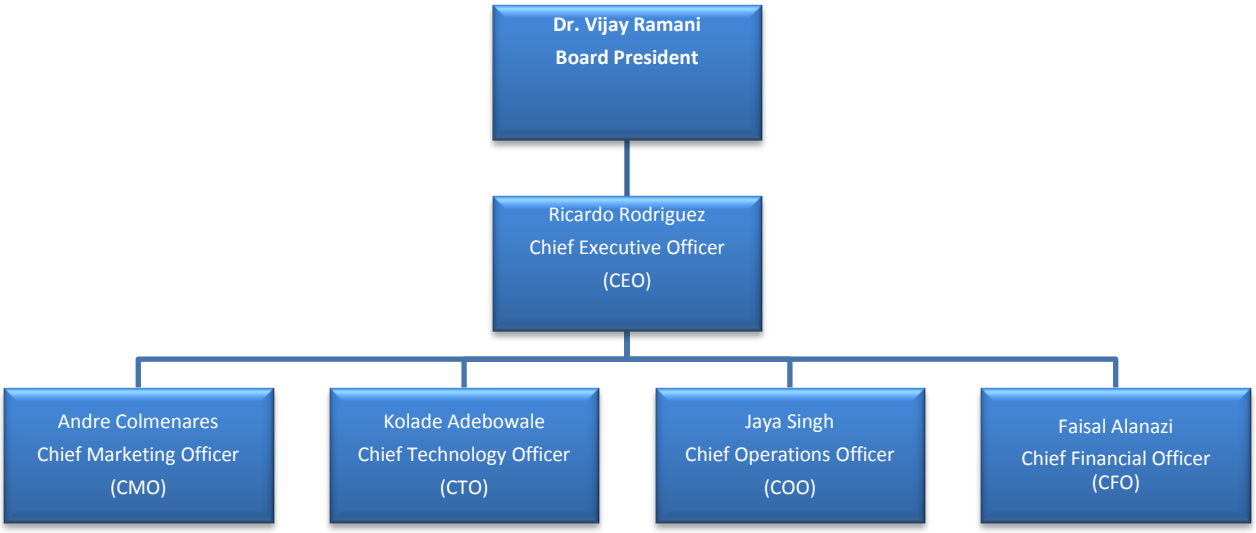


Figure 2: Management Summary

3.1. Management Biographies

3.1.1. Ricardo Rodriguez (Chief Executive Officer (CEO))

1. Promoted to Logistics Team Lead on demonstrating forward thinking that would translate to higher sales
2. Logistics Team Lead Train, evaluate and provide clear directions to the team members

3.1.2. Jaya Singh (Chief Operations Officer (COO))

1. Studied the electricity demand in the city of Chicago
2. Designing a Graphical User Interface (GUI) to calculate the productivity of the process
3. Potential use of GUI would be in future research

3.1.3. Faisal Alanazi (Chief Financial Officer (CFO))

1. Worked with WALAN Group Co. as Assistant Director of Personnel for 3 years
2. Worked with Saudi Hollandi Bank as Security Supervisor
3. Owned a business in the local cellphone and food market for two years

3.1.4. Kolade Adebowale (Chief Technology Officer (CTO))

1. Technician on Pilot Plants (Uniflex) May, 2010-August 2011

Plotbook Capability

2. Technician on Pilot Plants (Renewables) August, 2009-December 2009
3. Operated Pilot Plants (Renewables)

3.2. Licenses and Permits

According to the State of Illinois Liquor Control Commission, our business requires a manufacturer's application. This is defined as "every brewer, fermenter, distiller, rectifier, wine maker, blender, processor, bottler or person who fills or refills an original package, whether for himself or for another, and others engaged in brewing, fermenting, distilling, rectifying or bottling alcoholic liquors." "To manufacture means to distill, rectify, ferment, brew, make, mix, concoct, process, blend, bottle or fill an original package with an alcoholic liquor, whether for oneself or for another, and includes blending but does not include the mixing or other preparation of drinks for serving." All containers or packages of blended alcoholic liquors shall have a label clearly stating the names of all ingredients contained within the blended alcoholic liquors offered for sale. Under this application, our business would fall into the class 3 section brewer, which is defined as "any person who is engaged in the manufacture of beer. A brewer may make sales and deliveries of beer to importing distributors and distributors, in accordance with the provisions of the Illinois Liquor Control Act."

Additional federal documents are also required for submission; these documents are the federal basic permit under the federal alcohol administration act and the federal application for certification, exemption of label, and bottle approval. The federal basic permit under the federal alcohol administration act must be submitted in order to engage in the business of "producing or processing distilled spirits or wine includes for nonindustrial use." Nonindustrial use is defined as, "use of distilled spirits or wines [including] all beverage purposes or uses in preparing foods or drinks." "The FAA Act defines alcoholic beverages as distilled spirits, wine, or malt beverages including any fermented cereal beverages which have an alcohol content of not less than 1/2 percent." The federal application for certification, exemption of label and bottle approval "authorizes you to bottle and remove the product identified on the certificate from the bonded area of the plant(s) identified on the certificate where it was bottled or packed, or from Customs' custody." Submission of the manufacturer's application requires the submission of the previously mentioned federal documents, as well as the registration statement, and tax bond forms, enclosed within the document, and a deposit of nine hundred dollars. According to the Liquor Control Act of 1934, Chapter 43, paragraph 117, section 5-2, "All licenses, except a non-beverage user's, a special use permit, and a special event retailer's license, issued by the State Commission, shall be valid from the date of issuance through the last day of the eleventh month that begins after the month in which the license is issued." Renew of aforementioned licenses, and permits, will be completed on an annual schedule.

4. Our Beers

The beers we currently offer are all brewed using a German altbier style. Altbiers utilize top-fermenting (ale) yeast and are brewed at low temperatures (about 50 °F) in the lager style. They tend to be darker in color than their ale counterparts with some of the flavors and notes of a lager. Our beers exhibit varying degrees of these characteristics, ranging from lighter, lager-like tones to darker essences laced with bitterness and tang.

Light Sweet Crude

This is our most drinkable beer, carrying light-to-mid notes with a sweet, malty flavor. An ABV content of 5.5% makes this beer smooth.

Crude

This is our “in-the-middle” brew. Mid-range maltiness and a hoppy flavor (due to the addition of Tettnang hops not present in our other two brews) make for a pleasant yet spirited drink. The ABV is 6%.

Bitumen

As the name suggests, this beer is our darkest brew, possessing a high alcohol content (7.3% by volume) and potent bite.

Whichever of our beers, the customer can be sure that he or she is getting the best tasting beer offered at a price that most microbreweries can only dream of.

5. Design

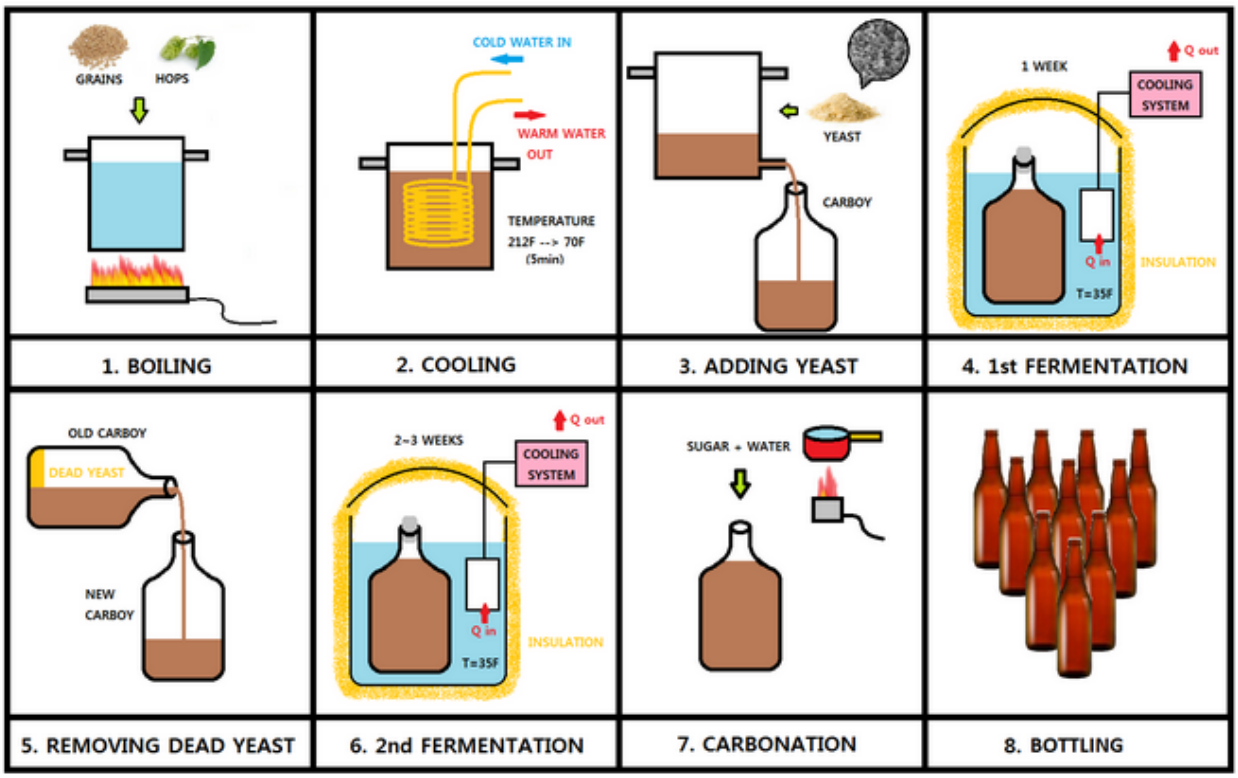


Figure 3: Process Design

6. Market Analysis

To ensure that we have a sound customer base for our product, we produced a market analysis to provide more detailed information about Black Gold. We are marketing our product to anyone on campus that is interested in responsibly drinking high quality beer. The geographical area that we are targeting includes the area where the university resides which is between Bridgeport and Bronzeville. Local breweries are continuing to prosper in a declining beer market, with sales of bottled beers growing by 16% a year, according to a report from the Society of Independent Brewers (SIBA). The report reveals local brewers produced more than a million hectoliters brewed for the first time in 2009, with sales growth of nearly 4% in a year of deep recession. This market looks like it has great potential. Some factors that might influence or affect the market include the determinants of demand such as the price of the beer, price of substitutes, and demographics. We will reach our customers through a strategic marketing plan. There are no known seasonal trends in the beer industry, but consumption may slightly increase during the spring and summer because of weather and more outside activities will increase thirst therefore creating a demand for beer consumption in some cases. The competitive edge that we have is that we provide beer that is not commercially brewed meaning that our university brewed beer provides a unique handmade quality to each batch brewed. We carried out our customer and market research through online surveys and through the social networking site Facebook. We obtained additional market research from online research. Customers should buy our product over many competitors because we do not produce our beer commercially it allows the customer to have the opportunity to receive a beer that is specially made and unique in every aspect.

7. Competition

The main competition our product will face is the regularly stocked beer at the Bog. Our primary weakness in this area is that our beer will be new and less refined than the mainstream brands usually offered at the Bog. Our product's principal strength will be its lower price, with a secondary benefit of its presence offering more variety. The strengths listed will almost certainly be enough to give to our product a completive edge at the Bog because the main customer base is college students who will be quick to take money saving options, and may be less attached to a particular brand or flavor. Should our product ever be sold in other establishments, it would have very much the same strengths and weaknesses as noted above. The table below summarizes some main factors in the competition.

Table 1: Strength Weakness Comparison

FACTOR	Know IIT Ales	Strength	Weakness	Competition	Importance to Customer (1 Critical, 5 Not Important)
Price	Very Low Price	x		Higher Price but Still Affordable	2
Name Recognition	Unknown to Campus		x	Well Established and Known	3
Advertising	Strong Campus Advertising	x		Only Broad Advertising	3
School Connection	Produced by Students	x		No Connection	3

8. Marketing Plan and Sales Strategy

With the economy still on the road of recovery, most people have to hold on tight to their wallets, and with the nature of a college student's budget, it is difficult to set a selling price that is highly profitable. The market we are mainly focusing on consists of students currently enrolled, visiting students, and faculty of the Illinois Institute of Technology's main campus. This should be a easily monitored target due to their abundant presence on campus.

Students visit the BOG (Campus Pub), the Pritzker club and the Center Court which sell alcohol for students and faculty above the age of 21 (with an ID). Since we now have more venues to market our product, the response should be higher and we can target a larger group of people.

In order to be able to sell our product, in this case beer, we will need several sales strategies. We could possibly give our free samples in small quantities to anyone who show's interest or wants' to try the product. We also could introduce the product at university and student events, pass out flyers and make brochures of the prices of the beer to people who attend the event. Since the price of the beer is not high, we are planning on selling it for $2 per bottle. Know IIT Ales can attract many customers, as the customer gets a quality beer for an excellent price.

9. Financial Plan

9.1. Financial Information

Start Up Cost
$3300.00

Table 2: Start Up Expenses and Assets

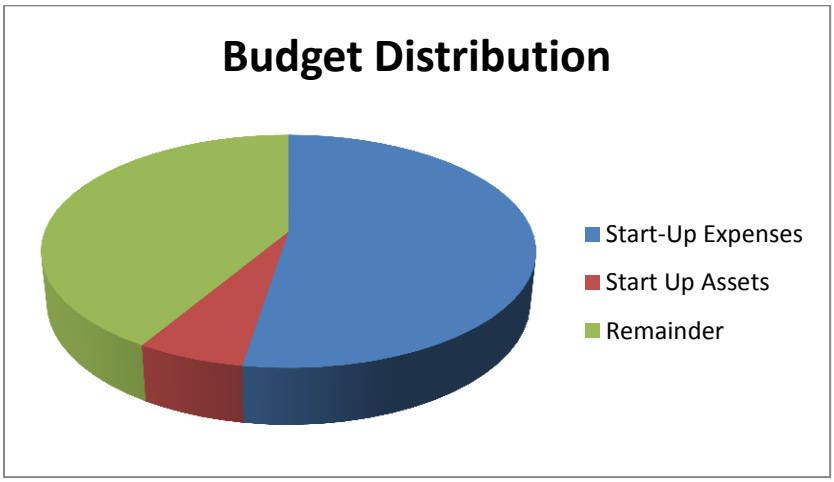
Start-Up Expenses	
Legal	$900
Brochures	$100
Long Term Assets	$700
*Rent	$0
*Utilities	$0
*Fire Protection	$0
Total	$1700

** Illinois Institute of Technology has generously offered its resources to aid the success of our endeavor.*

Start Up Assets Per 5 gal Batch	
Light Sweet Crude	$45.65
Crude	$44
Bitumen	$39.10

9.2. Cost and Price Per Bottle

Product	Cost	Price
Light Sweet Crude	$0.95	$2.25
Crude	$0.92	$2.00
Bitumen	S0.81	$1.75



40% of our budget will remain untouched as an emergency fund. These savings can will fund sudden replacements of materials and meet customer demands especially during yearly or monthly recreational events.

9.3. Break Even Analysis

To produce this theoretical calculation we have ambitiously stated 100% of products will be sold; to compensate for this, the number of following months has been reduced.

Table 3: Projected Profit and Loss - First Year

Projected Profit & Loss – first year													
	May*	Jun	Jul *	Aug	Sep	Oct*	Nov	Dec*	Jan *	Feb**	Mar*	Apr	Total
Sales Revenue	492	288	492	288	0	492	288	576	576	96	492	288	4368
Product Costs	218.4	128.75	218.4	128.75	0	218.4	128.75	257.5	257.5	45.65	218.4	128.75	1949.25
Gross Margins	273.6	159.25	273.6	159.25	0	273.6	159.25	318.5	318.5	50.35	273.6	159.25	2418.75
Salaries	0	0	0	0	0	0	0	0	0	0	0	0	0
Legal	900	0	0	0	0	0	0	0	0	0	0	0	900
Total Expenses	1118.4	128.75	218.4	128.75	0	218.4	128.75	257.5	257.5	45.65	218.4	128.75	2849.25
Net Profit	-844.8	159.25	273.6	159.25	0	273.6	159.25	318.5	318.5	50.35	273.6	159.25	1300.35

* Starred months are months that are expected to heed more revenue

** Assumption is that over production of beer from Dec and Jan will be in excess.

Table 4: Projected Profit and Loss - Second Year

Projected Profit & Loss – second year													
	May*	Jun	Jul *	Aug	Sep	Oct*	Nov	Dec*	Jan *	Feb**	Mar*	Apr	Total
Sales Revenue	492	288	492	288	0	492	288	576	576	96	492	288	4368
Product Costs	218.4	128.75	218.4	128.75	0	218.4	128.75	257.5	257.5	45.65	218.4	128.75	1949.25
Gross Margins	273.6	159.25	273.6	159.25	0	273.6	159.25	318.5	318.5	50.35	273.6	159.25	2418.75
Salaries	0	0	0	0	0	0	0	0	0	0	0	0	0
Legal	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Expenses	218.4	128.75	218.4	128.75	0	218.4	128.75	257.5	257.5	45.65	218.4	128.75	1949.25
Net Profit	273.6	159.25	273.6	159.25	0	273.6	159.25	318.5	318.5	50.35	273.6	159.25	2418.75

Cook County charges 0.06 dollars per gallon totaling to 27 dollars tax in total.

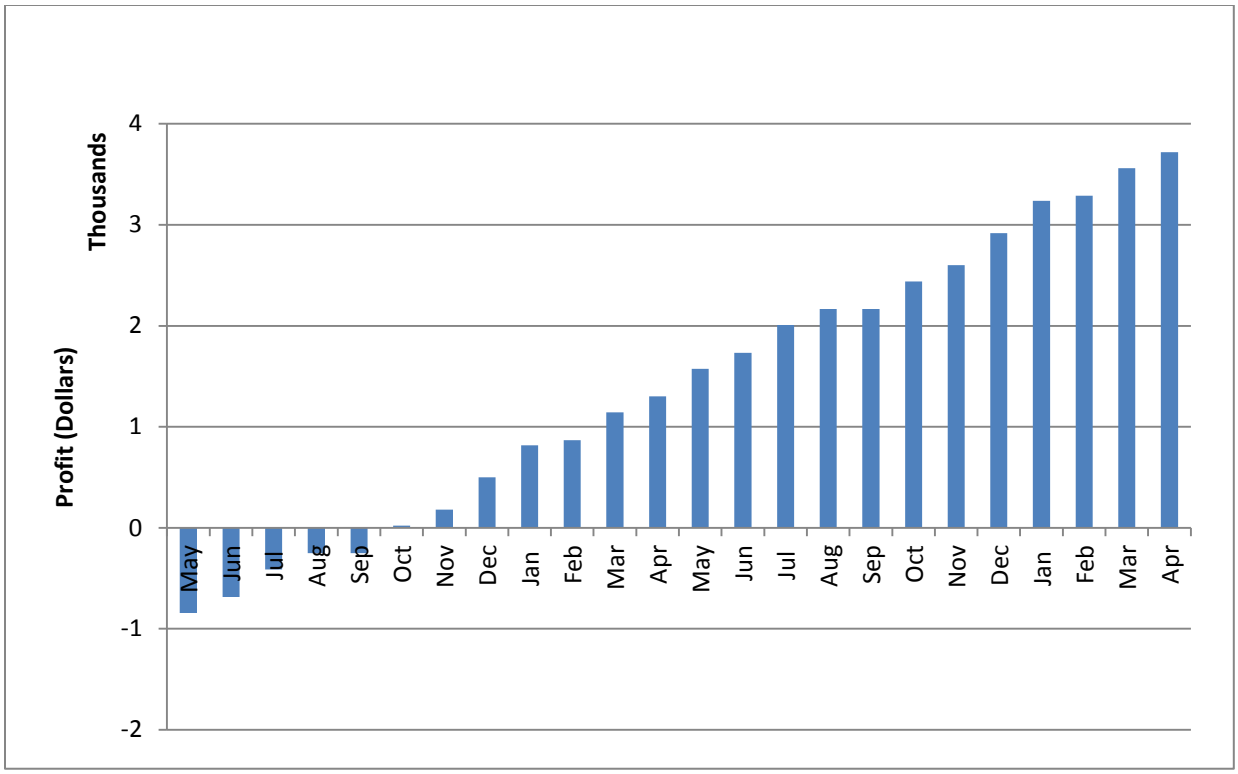


Figure 4: Cumulative Net Profit

Know IIT Ales would ideally break even in October. Statistics show that over 40 percent of the beverages sold at the Bog were priced fewer than six dollars. The lowest priced beer on the menu is 2.50. As the most affordable option, our Beer will be a best seller. And the end of just the first year we would make a profit of about $1300.

10. Refining the Plan

Expanding our business would require many additional licenses and permits. The additional forms that we would need are the retailer's liquor license, late hour license, and tavern license applications for the nightclub. The state retailer's liquor license allows our business to "sell and offer for sale at retail, only at the premises specified in such license, alcoholic liquor for use or consumption, but not for resale in any form; provided that any retail liquor license issued to a manufacturer shall only permit such manufacturer to sell alcoholic beverages at retail on the premises actually occupied by such manufacturer." The submission of the retailer's liquor license also requires, a copy of the certificate of insurance, and current local liquor license, prior state liquor license, bulk sales release order-address release, proof of purchase, federal employer identification number, Illinois business tax number, and a check or money order. The retailer's liquor license costs five hundred dollars, and "will coincide with the 12-month period that begins on the issue date of your local liquor license." The legal closing time for businesses is 2 AM.

The late hour license grants, "the additional privilege to remain open and permit the sale of alcoholic liquor until 4:00 a.m., Monday-Saturday, and until 5:00 a.m. on Sunday." The submission of the late hour license requires the site plan, floor plan, and late hour petition and related documents, as well as inspection by the local liquor control commission. This license will cost four thousand four hundred dollars, and a one-time publication fee of forty dollars, and will last for two years. In order to apply for the late hour license, our business must hold a tavern license.

The tavern license allows our business to "sell and serve alcoholic beverages as the primary source of business." "Patrons entering a tavern must be 21 or older. Persons under 21 may only enter a licensed tavern accompanied by a parent or legal guardian." Inspections required for the tavern license, include, onsite inspection, health, fire, DOB-Special inspection program, plumbing, and ventilation. As with the late hour license, the tavern license costs four thousand four hundred dollars, and the one time publication fee of forty dollars, and lasts for two years. In addition a public place of amusement license is needed in "taverns that offer live entertainment, charge admission for entry or have several amusement devices."

Licenses would also be required for those who would be serving the alcoholic beverages. The normal manufacture's license would still permit the distillation, rectification, fermentation, brewing, making, mixing, concoction, processing, blending, bottling or filling an original package with an alcoholic liquor, whether for oneself or for another, and including blending but not mixing or other preparation of drinks for serving.

Table 5: Action Plan

Key Objectives	Task	By Whom	By When
Determine Launch Plan	Outline Plan Agreement and decision on implementation	CEO, COO, and Director	Feb 15th
Create Brochure	Design and Print Brochure	Marketing Team	April 1st
Advertise	Post flyers and advertise because of end of the year events at the BOG.	Marketing Team and Financial Team	April 25th
New products	Think of new recipes and ways to attract a wider range of customers	Recipe and marketing	Summer
Prepare for Fall and Winter events	Produce large quantities.	Brewing team	Fall
Marketing	Advertise during new year's especially	Marketing	December through January
Finances	6 month gross calculations. Note trend and calculate if ends will meet for permit payment	Financial Team	December/January
Operations	Check if apparatus is running efficiently and if any parts need to be replaced	COO and rest of operations and brewing team	After each batch but thorough check at the end of each month