# *Design of a Brewery Manufacturing Process for a Small Starting Scale*

*Wilfredo J Cardona Vélez*
*Master of Engineering in Manufacturing Engineering*
*Rafael A. Nieves Castro, PharmD*
*Industrial Engineering Department*
*Polytechnic University of Puerto Rico*

***Abstract –*** *In this paper will be about the process and requirement to create a facility for brewery in order to implement Pilot Plant services. This project has a scope of preparing a Pilot plant focused in the opportunity of developing new variety of product, introduced by the home starter brewers, with an overview to a general methodology of brewing. Develop a list of equipments required for the marketing results conditions of productions. The results of the investigation can use as part of a business plan. Finding that from the pool of alternatives discussed the most viable conditions for the possible business under the assumptions made were renting a local, with an industrial like equipment inversion, and the passivity of three employees, since these conditions where above the 70% cost among the other options, but also was the most flexible of them all.*

***Key Terms:*** *Beer, Micro Brewery Design, Pilot Plant, Process Design.*

## PROBLEM STATEMENT

Beer crafting is one of the oldest industries in the world. Due to the growing market of the beer variety now day in Puerto Rico has created a new possibility of a growth of an old industry, beer crafting. Since there is, actually a desire to test new variety of beers, the market for beers has also grown.

### Research Descriptions

The study of the design of a microbrewery is essential to comprehend the creation of known product in order to create a new product to offer to the market. Moreover, helps creating awareness in their market viability, economics, and instrumentation for manufacturing process in this industry.

### Research Objectives

This project goal is to recognize an opportunity, study of the services and the fields where it would be growing as a pilot plant, discover which qualities the main customer desire. Moreover, the financial viability of the project including indicial capital cost of the project and its revenue. Create analysis of factors such as the cost associated production equipment, production area, packaging, and cleaning, of the new good will be analyzed in different scenarios such as scaling proposal. Also permits for the production and establishments of current Good Manufacturing Practices (cGMPs) for the manufacturing of the beer. Evaluate the maintenance of these facilities, including a schedule of requirements maintenance for each equipment.

### Research Contributions

Helps to create a new business producing a new service of standardize quality for market competitiveness, while search for an affordable and luring price. At the same time starts a quality culture in a new business of service. Moreover helps to obtain fundamental information for the construction of a Business Plan, which represents valuable information that will be needed when is implemented the project.

## LITERATURE REVIEW

There are several different processes to craft beer, which had been created through the ages. This process has varied, yet has certain step that remains the same. The main steps start with a mixture of water and a malted blend, where this process is called mashing, the malted mixture start the conversion of starch into sugars, followed by

the mixture separation (filtrated) or in as it's called in the brewing vocabulary lautering, to have liquefied sugars in the water separated from the grains. The wort, which is the liquid mixture extracted from the grains during the lautering, now the hops are added to the wort, which is a plant used to add the bitterness flavor and aroma, used to feed the yeast that will produce the effervescence and alcohol in the mixture. [1]

**Historical Background of Beer**

There are several types of alcoholic beverages. Under the category of fermented beverages are the beers and wines. This category is furthermore divided, where the beer also divides into two classes of beer, the ale beer and the lager beer. Is precise to know that the ale beer and the lager beer are not style of beer, but instead are the categories of how their fermentation takes place during the production of the beer. The beer is an alcoholic beverage produced through a process of fermentation that has been crafted since about the 4000 BC. Beer has made it way with certain variations in the process of production and consumption according to the culture where it was produced, Babylonians where among the cultures to have a variety of beer [2]. Later on history the beer process evolved through the middle ages where the largest amount of brewer crafter was on the monasteries.

One of the key steps in the beer production was recorded in Germany which is the introduction of hops or as it is called scientifically *"Humulus lupulus"*. The hops are the flowering cone of a perennial vining plant, which typically grows on climates similar to the one that grapes do. These plants are dioeciously, which means that the males and females flower grows on different plants. The ones used for the brewing process are the female cones. The use of the hops during the brewing process means to prevent the beverage of becoming rotten, since it works as a natural antibacterial. Moreover, the hops purpose on the beverage is to bring flavor and a touch of bitterness to balance the sweetness of the malts [3].

Later on the production of brewing evolved during the industrial revolution. It helped to produce beer more effectively. During this time, the brewing process comes across one distinctive flavor due to industrial revolution, which describes a smoky flavor in the finished beer. This flavor was caused from the smoke that comes of fires made from wood, charcoal or straw, since during the heating process the liquid was not shielded from the smoke. [4]

Now day, the beer making industry is a "global business that consists of several multinational companies, and many thousands of smaller producers ranging from brewpubs to regional breweries." [4]

**Beer in Puerto Rico**

The brewing industry started in Puerto Rico in early 1900's, evolving from an energy plant and an ice producing corporation. In 1938 the Cervecera de Puerto Rico, successfully introduced it's new product the "Cerveza India". A year later the Cervezera de Puerto Rico, introduced the still main holder of the market in Puerto Rico "Malta India" a non alcoholic brewing. In mid 1900's the Cervera de Puerto Rico changed its name to "Cerveza India and Malta India". In late 1900's is made the first light beer made in Puerto Rico, "Medalla Light"(1978). [5]

In approximately the 2005 Puerto Rico started a new trend of consuming more exotic beers than what the mixture of beers that what was usually consumed in Puerto Rico. Where the main consumed multinational brands in Puerto Rico are the "Heineken" beers, "Budweiser", "Coors Light", and the national beers, which are the "Medalla", "Key Stone" also produced by "Cervecera de Puerto Rico". This trend could be said that started with the opening of a microbrewery in the island called "Old Harbor Brewery". This brought different flavors of beers, such as lagers, stouts, pale ales, lager pilsner, [6] that created a new refreshing view of the concepts of beers in Puerto Rico.

### Pilot Plant

Pilot plants are part of the research and development of the manufacturing industry. The Pilot Plant helps to set the condition and ultimate equipment in which is transferred the process later. Since Pilot plant are part of the process of maturing a manufacture that helps stabilizing the conditions in which the process of manufacture will become at a larger scale. This part of the process is often known to be the next step after creating the drugs in a laboratory scale, although the Pilot plant process is often used as an experimental scaling process, in which helps setting parameters for large scale during the manufacture. Pilot plants are run with blend of experience and theoretical knowledge from the equipment. For them are required four types of space, the first one is the space of management, this is related to the documentation of the process and technique used during the process. An adequate space of testing, where is the area in which will be the practical work going on. Besides the management processing and testing area, there is the Pilot plant equipment floor space and the storage area. The Pilot plant equipment area is where all the equipment should be available for the test run in the procedure for later scale up adjustments. The storage area is where the raw materials are stored in order to keep their quality maintaining good manufacturing procedures. [7]

## METHODOLOGY

During this chapter will be the designed the research an approach to find which is the best way to design a microbrewery.

### Phase One

During this phase, will be pursuing to accomplish mainly two things. The first it means to accomplish the understanding of the logistic process that it is required to create a business and the brewing process. The second accomplishment desired to achieve is a clear knowledge of the beer specification. During this phase, it expects to implement two and a half week.

### Phase Two

During this phase, expected to be implementing four weeks of work, creating the design-required process for the brewing process to actually produce the beers, experiments and appropriate equipment. This phase expects to be implemented in about one week.

### Phase Three

After designing a Process Flow Diagram for beer as result of the work made in the phase before for the production of beer, analyze the possible equipments functions viabilities and costs, for the process and the critical steps of the process.

### Phase Four

During this phase will be dedicated to created a results reports given by the findings and analysis reports as well as suggestions from the results from the previous phases, this is expected to take about two weeks.

## RESULTS AND DISCUSSION

This section presents the results obtained in the research work and the discussion of them.

### Phase One

During this phase purpose, it pursued to accomplish two things. The first means to accomplish the understanding of the logistic process that it is required to create the brewing process and business. The second accomplishment desired to achieve is a clear knowledge of the beer specification.

### SWOT Analysis

The SWOT Analysis is a technique used to evaluate the market and the competitors. This technique helps to comprehend the project Strengths, Weaknesses, Opportunities, and Threats for the proposed service.

**Strength:**

- A chemical engineer and a human resource specialist will manage the enterprise.

- There is commitment to the enterprise since the owners run it.
- The Plant will be able to modify its process according to the need of the customer desiring an experimental batch of the product.
- The Pilot plant will have the capability on main personnel knowledge to transfer the technology from the pilot plant to the production plant.
- Will have the ability to be marketed the service through the local brewery plants.
- Does not have to worry about raw materials, since it expect to be supplied by the sponsors.

**Weakness:**

- Will be an enterprise depending in the desire of current business of developing new products.
- Lack of the basic or advanced equipment required for being a pilot plant project and Laboratory equipment.
- Requires budget to, develop a big and varied pilot plant to have more than one project simultaneously.
- It is a new business which lacks of previous reputation
- The Business is deficient of a place to locate the Pilot Plant.
- The implementation requires investing in the enterprise a capital that is not currently on budget.

**Opportunity:**

- Has the ability to design a pilot plant, including required space, equipment and procedures.
- Possibility of marketing the services through several.
- Variety of prices according to the type of services that the company will require.
- The business has the possibility to enlarge the future company to one of engineering services and transferring technologies outside the brewing specialization.
- Could buy used equipment from already established brewing companies to lower costs.
- Variety of options for the facility area required for the Pilot plant.
- The business could become from the pilot plant orientation, turn into a microbrewery-manufacturing environment.

**Threats:**

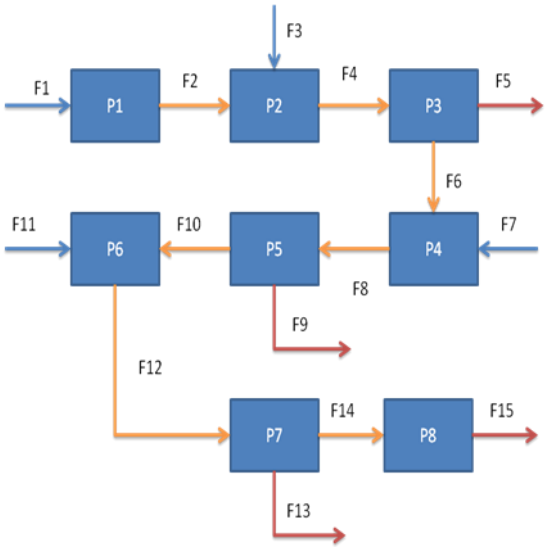
- Possibilities from banks to no lend money for the investment.
- The possibility of no upcoming processes or brews to test and use the pilot plant.
- Does not have yet the permissions.
- Possibility of higher cost than a Return of Investment.

## Phase Two

During this phase was be implemented the creation the required design for the brewing process to actually produce the beers experiments and appropriate equipment. Moreover was analyzed the possible equipments functions, viabilities and costs, for the process and the critical steps of the process.

## PFD Analysis

The Process Flow Diagram presented below in Figure 1, represents the general stages of the process, which takes place in order to create a beer. The first step in the process incurs when the malted grains are milled. After the grains are milled are mixed in water and boiled. This procedure is to turn the starch from the grains into sugars also known as saccharifications. Later when the saccharification process is completed begins the lautering process, which is the filtration of the grains from the mixture of the boiled water and the mashed grains. The worth it's once again boiled, but now with a new component added, the hops, creating the bitterness and characteristic flavor in the beer. After filtering apart the hops, the worth is let down to cool down, when worth is at ambient temperature the worth is sent to the fermenter with the yeast, to produce alcohol therefore the beer. Then the beer is separated from the yeast by whirpooling, when the beer is free from the yeast is ready to package and store.




**Processes:** P1 - Milling grains; P2 - Mixing, stirring and heating, grains in water (Mashing); P3 - Filter the water with grains from the milled grains (Filtering the Wort); P4 - Heating the wort with added hops (this process could be repeated in some cases); P5 - Filtering the hopped worth; P6 -Fermentation; P7 - Filtering/Whirpooling; P8 - Packaging Beer. **Process Flow Diagram Legend:** F1 - Entering malted grains; F2 - Milled Grains; F3 - Water inflow; F4 - Mixed grain and water (mashing); F5 - Used Grains; F6 - Worth; F7 - Hops; F8 - Hops and Worth; F9 - Used hops; F10 - Hopped Worth; F11 - Yeast; F12 - Polluted Beer; F13 - Used Yeast; F14 - Beer; F15 - Packed Beer.

**Figure 1**
**Process Flow Diagram**

## Phase Three

After reviewing the design of the Process Flow Diagram for beer, this phase now focuses on the analysis of the possible equipments functions viabilities and costs, for the process and the critical steps of the process stated during the Phase 4.2.

The first cost factor taken in consideration was the human factor. This enterprise expect to be managed and ran, with two to three well-trained personnel; they will have an average workload of 40 hours a week and an average hourly wage between them three of $15.60/hour, estimating a yearly need in salary of $64,900.00 to $97,400.00.

The second factor taken in consideration was the list of equipment required for the procedure described previously in phase two, with respective equipment qualities and prices.

The list of the equipment reviewed and presented before along with the materials that fit the profile for a pilot plant and tabulated as can be seen in the following Table 1. Where under the description is the equipment name, the purchased equipment cost is the retail equipment cost, while the bare module cost involve indirect cost besides the equipment cost such as maintenance, spare parts, and sub equipment such as stirrer, thermometers, fittings, and protective gear. Moreover it's marked down with (**) all those equipment that are more likely to be either substituted or increase in amount of consumption yearly, for a period of five years.

The equipment cost projection reflects a range with a minimum of $ 3110 and an increase to $4,700, this is expected to be an initial investment in equipment for a period of five years. Other options simulating an industrial environment production cost are the equipment as follows.

**Table 1**
**Focus in non-Industrial Equipment**

| Description | | Purchased Equipment Cost | Bare Module Cost |
|---|---|---|---|
| Miller | | $ 150 | $ 200 |
| Boiler | | $ 120 | $ 180 |
| Boiler | | $ 120 | $ 180 |
| Filters | | $ 43 | $ 50 |
| Filter | | $ 43 | $ 50 |
| Stove | | $ 80 | $ 200 |
| Piping | ** | $ 100 | $ 200 |
| Piping | ** | $ 345 | $ 460 |
| Fermenter 6 | | $ 40 | $ 80 |
| Fermenter 7.9 | | $ 25 | $ 70 |
| Fermenter 16.5 | | $ 60 | $ 130 |
| Bottles | ** | $ 685 | $ 900 |
| Fridge 19.7 | | $ 1,000 | $ 1,500 |
| Crystal Jars | ** | $ 50 | $ 150 |
| Cleaning Material | ** | $ 200 | $ 350 |
| | Sum | $ 3,110 | $ 4,700 |

The equipment cost projection reflects a range with a minimum of $ 3110 and an increase to $4,700, this is expected to be an initial investment in equipment for a period of five years. Other options simulating an industrial environment production cost are the equipment as follows.

When analyze the option simulating an industrial environment production the equipment

cost projection reflects a minimum of $ 4,324.90 in simply equipment, this cost increase to $6,839.98 when is taken into consideration maintenance and spare parts, this cost will be an average range of an initial investment in equipment for a period of five years as can be seen in Table-2.

The Cost analysis until the moment is solely in the pilot plant as manufacturing in experimental standards. Things that do not take in consideration are the laboratory procedures that will take to measure the final product quality, such as the viscosity test, pH, and effervescence among others. What does take in consideration are the purchasing in complementary equipment such as temperature measuring and controlling agents in the equipment.

**Table 2**
**Focus in Industrial Equipment**

| Description | | Purchased Equipment Cost | Bare Module Cost |
|---|---|---|---|
| Miller | | $ 149.99 | $ 200.00 |
| Boiler | | $ 119.99 | $ 180.00 |
| Boiler | | $ 120.00 | $ 180.00 |
| Filters | | $ 42.50 | $ 50.00 |
| Filter | | $ 42.50 | $ 50.00 |
| Stove | | $ 80.00 | $ 200.00 |
| Piping | ** | $ 100.00 | $ 200.00 |
| Piping | ** | $ 345.00 | $ 460.00 |
| Fermenter SS | | $ 1,299.99 | $ 2,339.98 |
| Fermenter 6 | | $ 40.00 | $ 80 |
| Bottles | ** | $ 685.00 | $ 900.00 |
| Fridge 19.7 | | $ 999.99 | $ 1,500.00 |
| Crystal Jars | ** | $ 49.95 | $ 150.00 |
| Cleaning Material | ** | $ 250.00 | $ 350.00 |
| | Sum | $ 4,324.90 | $ 6,839.98 |

Among other of the factors taken in consideration for the pilot plant implementation, is the area of work and availability of the area. This area has to have production area, cleaning area, storage area, laboratory facilities and office area, to find a place with enough space to have this areas or the combination of those. While searching there are several options as follow in Table 3.

The consideration of a Step van, as an options come from the symbiotic business environment. Where the sponsor which is using the services of the pilot plant, have immediate access to results of the pilot plant results, at the same time Pilot plant agency supplies the equipment for the experiments while the sponsor supply the pilot plant with storage and utilities.

**Table 3**
**Facilities**

| Area | | Price Range | |
|---|---|---|---|
| | Step Van | $ 8,000.00 | $ 35,000.00 |
| | Purchased building | $ 88,000.00 | $ 200,000.00 |
| | Monthly Rent | $ 800.00 | $ 2,500.00 |

In other hand, there is the possibility of purchasing or renting a local. The benefit of this options compared to a step van is that has more space to handle the equipment and a local where can be associated with a business instead of a "food car". When it comes to comparing between renting or purchasing will depend on the immediate future of business proposal. Since this business calculates to be a five-year standing business, the cost from a local that cost $88,000 that most likely is in imminent needs of repairs due to the low price in the local, which raises the actual cost of the local, not seeming too viable for a five year projection. While the estimated cost of a rented local at $800.00 as the cheapest possibility when it looked into a five-year projection the cost is about $48,000 which seems more affordable for as a first option as a local.

If in the other hand the business at mid stages of its progress seems to blossom more than the projected expectation in terms of live of the business, then could change from the renting a local option to a buying local option.

The anticipated cost from the facility renting/purchasing varies from $60,000.00 to $155,000.00. In this cost takes in consideration the needs from the facility to be set according to the needs of the pilot plant and government requirements for the facility to operate. Also has in consideration if it going to be only rented during a period of five years, with the cost of $60,000.00 or if it's going to be initially rented and then purchase

to own a facility with a forecast of $155,000.00 as an overall net present cost.

When this cost are set into yearly basis, the cost for the option of solely renting a facility in a year basis estimates $11,250.00, with an initial cost during the first year of $15.000.00 of settlement as mentioned before. While for the option of renting and after approximately two years buy a facility, it start with a cost of $15.000.00, and $11,250.00. During the following two year, at the end of the third year will likely incur in another initial investment that will be required for the new facility in order to decrease cost attributed to facility after the next ten years is initially needed approximately $20,000, and about $14,500 each following year during following 9 years.

This also expect to have a utility cost involved which is expected to be an average of $3,000/month for both water and energy, that leads to about $36,00/year.

The summarized Scenarios are Work Force: two or three employees; Equipment: Industrial or Non-Industrial Equipment; Facilities: step van, purchase an establishment or rent an establishment, utilities: provided or not provided.

**Annual Operation Cost Analysis and Results**

The following section represents the Cash Flow behavior through the year's different opportunities. Here expect to see possible project cost forecast, which were calculated taking in consideration the already discussed scenarios: highest cost for equipment and the lowest cost in each type of facilities, with exception for the step van that takes in consideration the purchase of a used step van and a brand new one. All this is forecasted for both situations when there are two employees and three employees. For the analysis is being based in the assumption that the loan asked is with at 10% of interest for the amounts presented as follow including a first year of salary for the employees. Moreover, these numbers expects to be part of a hybrid loan from a mortgage loan and business loan.

The Table 4 represent the base lend money from the loans and the amount required paying in either, 5, 10 or 15 years with an interest of 10%. The amount to be finally paid stated in a Net Present Value (NPV) for each set of year and their respective combination of the summarized scenarios.

The annual operation cost for decision 1, for a period of five years, where chooses the work force to be two employees, the equipment its decided not to be industrial, and the Facilities chosen was the Step Van, and the utilities will be provided since be sponsored by the contracting part. For a business, life under condition 1 represented in the combination tables, has estimated life of five years, and the expected income to breakeven and fulfill loan payments to the bank of $20,470, for the first year, but the following years due to work force increases to up to $85,400 yearly.

As for the second annual projection, the highest for the same business life span. This projection has in consideration the following options, buying a facility, a work force of three employees, with a first year of salary, and concurrent work force of 3 employees for the life span of the business, represented in the combination as the condition 12. A first year of utility cost and following cost for the business life span, initial with the equipment early mentioned as industrial equipment. That results in a cost of $60,200 for the first year and a yearly cost of $193,000 for the following 4 years.

Since this conditions are in terms of longevity are invalid for an actual loan payment situation, it was calculated the same conditions the same conditions as before but for a payment time set to 15 years. Assuming the utility cost will not vary greatly from the start and the work force remains the same.

Analyzing for a third possible decision renting a facility, represented in the Table 4 as the condition 14 & 16. From where was observed that the initial operation cost for the first year, analyzed with the condition of two employees, resulting $31,000 cost during the first year, with a

consecutive year cost of $141,448.94 for the four following years. However, when the operation cost calculated for an amount of three employees, the cost of the first year is $39,550 with $183,000 operational cost for the next four years.

After exploring the possibilities and analyzing numbers, for the annual operational cost observes that, there was a significant difference between the amounts of employees for the company. This makes the working force the main limiting factor in terms of revenue. The range for annual cost lies between $20,470 and $60,200 for the first year, but the following years $85,400 and $193,000. This at the same time is the cost for the business plan for five year. In order to have a break even the required is to have revenue of zero for each scenario. That means that yearly the company has to have a minimum of $85,400 for the lowest operational cost scenario. The expected amount of projects duration is of six month, meaning that in that time the projects made has to have a profit of at least 85,400.

### Phase Four

This phase dedicated to the creation of a business statement for a decision-making, given the result, findings and analysis reports as well as suggestions from the results from the previous phases to generate a well-defined business plan.

### Business Statement for a Decision-Making

Since this is a new type of project, where is creating a business of service for the brewing companies in Puerto Rico. Where the demand and offer for this kind of service since is relatively new is unknown. What is expected to happen is that the companies have several projects at the same time, up to 3 project every 6 month, since there are 2 limiting factor is the equipment in terms of capacity and the personnel, which don't allow to do more projects at given time.

**Table 4**

**Different Conditions Set-up and Expected Lend Money for 5, 10 and 15 year.**

| Combination (Used StepVan) | 1(non industrial) (2 Work Force) | 2(industrial) (2 Work Force) | 3(non industrial) (3 Work Force) | 4(industrial)) (3 Work Force) |
|---|---|---|---|---|
| Base Loan | 77596 | 79735.98 | 104596 | 106735.98 |
| NPV for 5Y | 102348.15 | 105170.75 | 137960.81 | 140783.41 |
| NPV for 10Y | 126283.92 | 129766.64 | 170225.17 | 173707.89 |
| NPV for 15 Y | 153027.59 | 157247.86 | 206274.47 | 210494.74 |

| Combinations (New Step Van) | 5(non industrial) (2 Work Force) | 6(industrial) (2 Work Force) | 7(non industrial) (3 Work Force) | 8(industrial) (3 Work Force) |
|---|---|---|---|---|
| Base Loan | 110044.00 | 112183.98 | 137044.00 | 139183.98 |
| NPV for 5Y | 145146.65 | 147969.26 | 180759.31 | 183581.92 |
| NPV for 10Y | 179091.54 | 182574.26 | 223032.80 | 226515.52 |
| NPV for 15 Y | 217018.50 | 221238.77 | 270265.38 | 274485.65 |

| Combinations (Purchase) | 9(non industrial) (2 Work Force) | 10(industrial) (2 Work Force) | 11(non industrial) (3 Work Force) | 12(industrial) (3 Work Force) |
|---|---|---|---|---|
| Base Loan | 193596.00 | 195735.98 | 226044.00 | 228183.98 |
| NPV for 5Y | 255350.69 | 258173.29 | 298149.19 | 300971.80 |
| NPV for 10Y | 315068.57 | 318551.29 | 367876.20 | 371358.92 |
| NPV for 15 Y | 381791.96 | 386012.23 | 445782.88 | 450003.15 |

| Combinations (Rent) | 13(non industrial) (2 Work Force) | 14(industrial) (2 Work Force) | 15(non industrial) (3 Work Force) | 16(industrial) (3 Work Force) |
|---|---|---|---|---|
| Base Loan | 115196.00 | 117335.98 | 147644.00 | 149783.98 |
| NPV for 5Y | 151942.07 | 154764.68 | 194740.58 | 197563.18 |
| NPV for 10Y | 187476.19 | 190958.90 | 240283.81 | 243766.53 |
| NPV for 15 Y | 227178.80 | 231399.07 | 291169.71 | 295389.98 |

If it has to be chosen a plan of action immediately, the best decision to make after considering the factors of the numbers, the business should start with the rented a local, with 3 employees, and an industrial equipment for the services. The reason of this alternative is because is the most flexible of all the alternatives, since this are only expected economic conditions. That also prepares the company to opt for alternatives to make decision easily, like a change of settings such any kind of downgrade like is as workforce downgrade or facilities downgrade, or even an upgrade in facilities if is required. This option economically covers most the stated situations up to 77% of the total situations planted, meaning is the safest to prepare. Also, if it is going to be one project every 6-month, means that the minimum price of the services will be $92,000 in order to break even, although a more luring price per project would be $45,000 incurring in 4 to 5 project in a year to achieve a breakeven.

During the analysis stated that the factor that cost the most was the work force, being $64,900 for two employees paid an average of $15.60/hour for 40. The work force is besides being the most expensive cost factor, is also the most variable factor. Factor that can iterate to a value more settling, if during the development of a future business plan discovers the market value of this service for the brewery industry, is either significantly higher or lower than the presented considerations to breakeven.

### Suggestions

In order to use this research to complete a good business plan should do a reckoning of the market share for the services of this category. Also, develop a good promotional plan for advertising the service as well as recognition of other possible targets for the pilot plant service. When developing a promotional plan analyze the quality and regulatory standards when doing the promotion in order to have a more appealing to the possible customers. In addition, a good business plan should have a well-defined set of milestones, action plan, and not least important an exit strategy.

## CONCLUSION

Designing of a pilot plant as microbrewery helped to understand, the creation of known product in order to create a new services and offer it to the market. Moreover, creates awareness of how to expect a business to behave in terms of economical factor, viability and instrumentation for manufacturing process. By using knowledge of logistic, process design implementations related to a pilot plan and applying them to a business, foments the business to start with Quality By Design. Also by applying SWOT knowledge, creates a attentive business by being aware of the risk it might imply. Smooth the progress of understanding how the processes of the brewing might take place through the Flow Process Diagram, depending on the request of the sponsoring agency that contracts the services of the company.

In addition, this project facilitates the decision making for a variety of possibilities with solution and suggestions for similar situations. Moreover, through the project analysis helps to any other starting business to orient them when comes to do more concrete, and well-based decisions through economical analysis.

Finally, this defined project compiles several aspects for a specific business plan such as being used as a supportive document for a business plan, or be part of a business plan since the project include background of the business, operation process and financial projections information that can be used to complete one business proposal.

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