

BeeMusa Straw: A Project Feasibility on Utilization of Banana Leaf as Eco-Friendly Straw

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ABSTRACT

The Philippines is considered to be the third largest contributor to plastic waste worldwide and considered as a long-term problem that sought to resolve over time. The proponents have come up with the idea of making a compostable straw that is made out of bio-plastic with processed banana leaf for their Project Feasibility by putting together their resources and setting up BeeMusa Enterprise. New version of straw is made for the continuous change and improvement on the environmental issues. Introducing this new straw where banana leaf was used as the primary material of BeeMusa straw. The BeeMusa Enterprise created a new Eco-friendly straw that can start to maintain the cleanliness. The product will be sold by pack for ₱30 consisting of 10 pieces straws. The company will supply the businesses like milk tea shops, restaurant and shake vendor, around the company location in Barangay 171 Bagumbong North Caloocan City. For the 1st year of BeeMusa Enterprise production, 8 workers are needed for the daily capacity of the company. Each pack will be processed 1.59 minutes and can produced 212 packs a day to meet the supply each business needed. All materials for this product are organic from the primary materials which are the beeswax and processed banana leaf up to secondary materials which includes glycerin, starch and vinegar and no preservatives included. It is to avoid the chemicals to our product making it zero plastic content but this is not edible and it will decompose naturally in our composed bin.

Keywords: Bioplastic, Sustainable, Banana Leaf, Eco-Friendly, Compostable, Organic

INTRODUCTION

Single-use plastics have been ingrained in people's daily lives due to their convenience, ease of use, and it make low-cost consumer items available to low- and middle-income people or families, resulting in a significant and massive environmental burden. Based on the recent reports and studies, in 2021, the Philippine plastic production generates an astounding 2.7 million tons of plastic waste a year, of which about an estimated of 20 percent ends up in the ocean. With over 7,500 islands the Philippines coastal population, as well as the fishing, shipping, and tourism industries, are particularly exposed to the effects of marine debris. (World Bank Organization, 2021). The Philippines is also considered as the third largest contributor to plastic waste worldwide, of which about contributing to an estimated 0.75 million metric tons of ocean plastic every year (Guevarra, 2022).

People have been using plastic straws for a thousand of years. Plastic straws are commonly used nowadays, and plastic straws are an unneeded utensil for the vast majority of individuals, and they are typically discarded after only one use. Plastic straw may be small and light, but they are a major issue especially in the environment and in human health. Since plastic straws cannot be recycled, they end up in landfills and incinerators, where they litter the streets, parks, and roadside, clog our gutters, and pollute a lot of rivers, lakes, and streams, and where plastic straw may linger for about more than 200 years. Furthermore, a lot of single-use plastic straws are made of polystyrene, the same material that is used to create Styrofoam, which is probably carcinogenic to humans. And to summarize, plastic straws are not only an issue to the environment, but also a major issue for people's health.

Drinking straws, particularly plastic straws, evolved with little regard for the environmental impact that may cause. Massive efforts are currently ongoing to alleviate the environmental stress caused by all human activities and industrial sectors, including the beverage industry. There are several environmentally beneficial substitutes for disposable plastic straws available on the market. Straws made of paper and bamboo are among the most often used and are both compostable and biodegradable.

BeeMusa Enterprise have proposed and come up with the idea of making a compostable straw that is made out of bio- plastic with processed banana leaf. And with this, a new version of straw is made for the continuous change and improvement on the environmental issues. Furthermore, introducing this new straw where banana leaf was used as one of the primary materials of BeeMusa Straw. Since BeeMusa straws are composed of plant- based materials, they can decompose easily after use and don't produce any waste. Additionally, BeeMusa straws have a minimal ecological footprint, which is advantageous because smaller ecological footprints have less of an influence on the environment. The fact that Beemusa straws can be composted is one advantage. This indicates that when properly disposed of, the straws will naturally disintegrate into smaller pieces. In addition, BeeMusa straw is not edible because of banana leaf fiber content is too high but it will not poison human when it is consumed because the banana leaf was processed properly and the made product itself will not affect or mix in the beverages because beeswax is utilized as waterproofing agent and the beeswax is one of the primary materials of the product. Using of BeeMusa straws, people will not only lessen the influence on the environment but also contribute to safeguarding it for future generations. Plastic straws are frequently made of dangerous compounds, such as BPA, which can cause health concerns if consumed. BeeMusa straws are far safer than plastic straws, because they do not easily break or become entangled in food. BeeMusa Enterprise, a manufacturing company wants to make a difference by utilizing banana leaf to make an extraordinary biodegradable straw. Starting with this product BeeMusa Straw, a straw made from banana leaf, showing that a drinking straw does not have to be made of plastic materials, which is exactly what the Beemusa Enterprise aspires to be.

METHODOLOGY

This study aims to create and develop a BeeMusa Straw, that is organic, zero content waste, non-toxic and a biodegradable straw by utilizing processed banana leaf, and beeswax as primary materials and some organic materials to make the product.

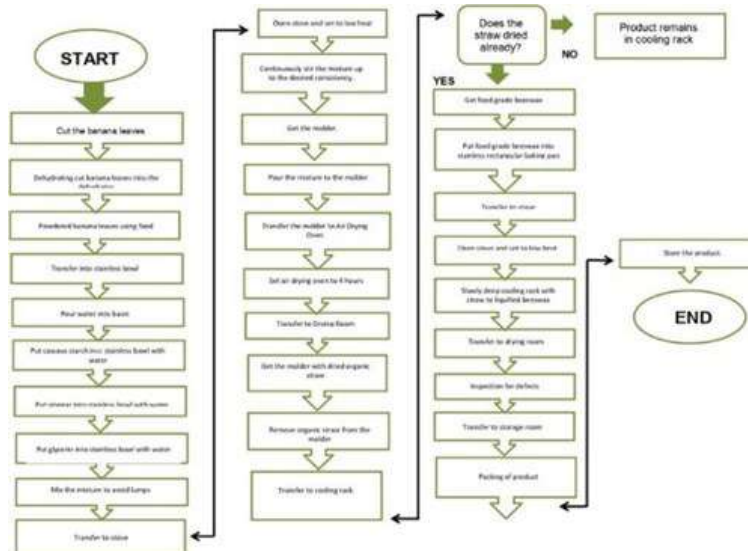


Figure 1. Process flow Diagram of BeeMusa Straw.

The BeeMusa Straw|| is an eco-friendly and zero waste organic drinking straw that can be used by any individual specifically by individuals who drinks cold beverages and people who owns small and medium businesses that sells cold beverages like Frappe, shakes, and Milk tea. BeeMusa straw is an eco-friendly straw that is biodegradable and safe for human use, and a perfect alternative or great substitute for plastic straws that have undergone chemical processing. BeeMusa straw has zero content plastics and made from organic or natural and non-toxic materials such as Glycerol, Vinegar, Cassava Starch, powdered Banana Leaf and food grade Beeswax.

PRODUCT DIMENSION

- Comes in Green Color
- Standard Length: 200mm
- Standard Diameter: 14mm

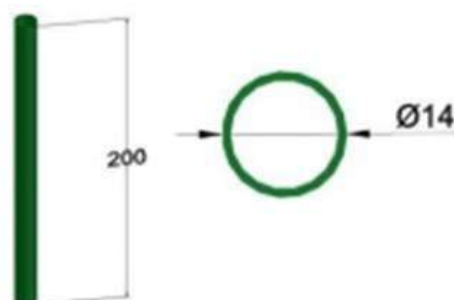


Figure 2. CAD Layout of BeeMusa Straw.

Figure 1 shows the start to end procedure of making the BeeMusa Straw from cutting, drying, and storing procedure in total the proponents come up to 31 elements of process on making organic straw.

Figure 2 shows the CAD layout of BeeMusa Organic straw this dimension is based on standard specification of Boba Drinking straw that are already on the market.

Sl. No.	Test/Analysis	Starch Bioplastic	Composite Bioplastic	Results Deviation	Remarks
01	Thermal decomposition (50% of weight loss)	291 °C	303 °C	12 °C	Increased (4.12%)
02	Melting temperature (T_m)	297 °C	303 °C	6 °C	Increased (2.02%)
03	Glass Transition temperature (T_g)	57.2 °C	66.8 °C	9.6 °C	Increased (16.78%)
04	Tensile Strength	3.55 ± 0.035 MPa	3.95 ± 0.039 MPa	0.4 ± 0.004 MPa	Increased (11.26 %)
05	Elongation (%)	88.1	62.5	- 25.6	Decreased (29.05 %)
06	Surface Roughness (Average)	0.6 μ m	1 μ m	0.4 μ m	Moderate Decreased

Table 1. Comparative Analysis of starch Bioplastic and Comparative Bioplastic.

The degradation of bioplastics is affected by water content, moisture, and oxygen level. Resistance to degradation of bioplastics made of cassava starch was strongly influenced by the amount of glycerol used as the plasticizer. The greater the amount of glycerol was used, the faster the degradation process (the complete degradation occurred on the 9th day), the higher the moisture absorption, and the longer the shelf life (in a dry place) would be table 1 shows the comparative analysis according to (Malang Indonesia state University, 2017) to conform to proper degradation of BeeMusa straw and proper storage.

RESULTS AND DISCUSSIONS

The graph result presented are the generated results during the ocular visits to survey in 52 business along Barangay 171 Bagumbong North Caloocan City. During gathering ocular survey in 52 business the result will be used to compute the projected demand, projected supply needed to accompany the target market.

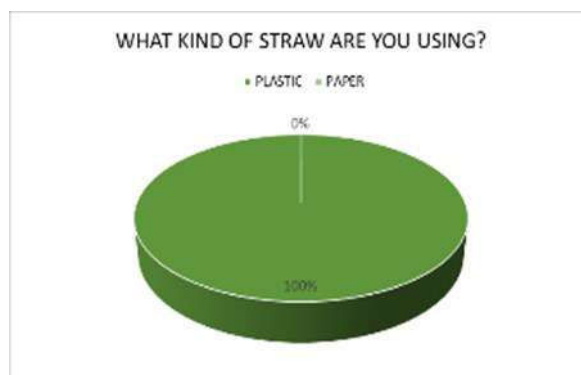


Figure 3. shows that hundred percent of businesses are using plastic straws no one uses paper straw

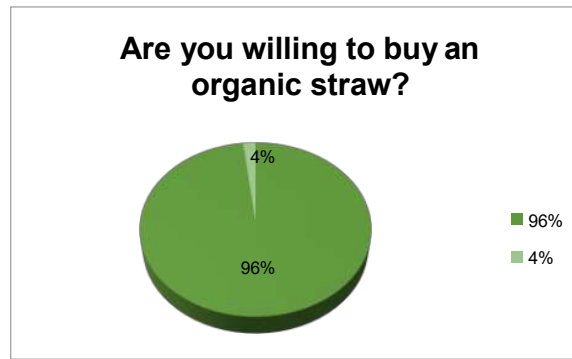


Figure 4. shows the percentage of the frequency distribution.

Figure 3 and 4 shows the results on questions “what straw are you using?” That has 100 percent of the target market answers yes while on the question of “Are you willing to buy an Organic straw” has the result of 96 percent yes on the target market population this question was gathered to compute for the possible demand and supply of this feasibility study.

Table 3: Forecasting Methods

Forecasting Method	Standard Deviation
THE ARITHMETIC STRAIGHT-LINE METHOD	1,399
THE ARITHMETIC CURVE METHOD	1,069
THE STATISTICAL STRAIGHT-LINE METHOD	18,831
THE STATISTICAL PARABOLIC PROJECTION METHOD	1382

This figure shows the standard deviation of all the forecasting methods used. These four forecasting methods indicates that the least value standard deviation will be used for determining the target demand. The arithmetic geometric curve method will be used since the standard deviation result of arithmetic geometric curve method is the smallest among other forecasting method.

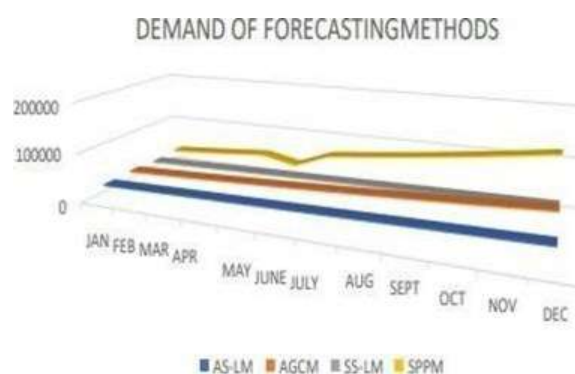


Figure 5: Demand of Forecasting Methods

This figure or graph shows the flow of forecast demand in each forecasting method.

Table 2. Projected Annual demand per pack

YEAR	ANNUAL DEMAND (96%)	PACKS	TARGET DEMAND (82%)	FOA	ANNUAL FORECAST DEMAND
2023	593,457	59,346	48,663	7.60	370,045
2024	705,596	70,560	57,859	7.60	439,968
2025	989,521	98,952	81,141	7.60	617,007
2026	1,105,324	110,532	90,637	7.60	689,215
2027	2,032,456	203,246	166,661	7.60	1,267,320

The table shows the Projected Supply per pack, Weekly and Monthly according to the percentage on the survey, of agreed that they will buy straws weekly and monthly.

General Marketing strategy is the comprehensive plan formulated particularly for achieving the marketing objectives of the organization. It provides a blueprint for attaining these marketing objectives. It is the building block of a marketing plan. The "Four Ps" of marketing—product, pricing, place, and promotion—are all covered in a good marketing strategy. BEEMUSA Enterprise use the 4Ps to figure out what their customers demand from them, how their product or service fulfills or fails to satisfy those demands, how their product or service is recognized in Valenzuela City, how they differentiate themselves from their competitors, and how they participate with their customers.

The proponents used the Location Factor Rating Method to know where the best location to start up the company. The proponents found Three locations in Valenzuela City, specifically on the three barangays: Barangay Bignay, Barangay Marulas, and Barangay Ugong, Valenzuela City there are three business location founded. The proponents chose one of the best locations in every barangay in terms of space and price.

Table 4. Location Factor Rating Method

FACTORS	Weight (%)	Rating	Weighted Score	Rating	Weighted Score
Availability of Raw Materials	0.35	80	28	90	31.5
Proximity to Customer	0.3	95	28.5	90	27
Transportation Cost	0.2	90	18	80	16
Space Requirements	0.1	95	9.5	90	9
Proximity to competitors	0.05	80	4	70	3.5
Total	1		88		87

Table 4 shows the factor rating method The table shows the numerical data and results of Location Factors Rating Method.

The first column shows all the possible factors that may affect the business, the second column the list of the corresponding scores based on its importance to the business; then the proponents set scores considering all factors. The next procedure is to multiply the Importance Ratings by the Importance Weight individually to get the Weighted Scores of all barangays, then find the Total of the Weighted scores of all barangays and compare. In conclusion, the location having the highest weighted score is 88, located at Barangay Bagumbong, North Caloocan City.

Promotion Strategy

BEEMUSA Enterprise will establish customized campaigns and an infographic through social media platforms, this offer will establish an immediate connection with the customers and will strengthen the bond with the company. Advertising is a form of introducing products and raising awareness with the purpose of persuading people to attract interest, engagement, and sales. Advertising is used as a promotional technique since it catches the attention and reaches a larger audience.

Facebook

Since Facebook has a lot more users, this will give the company an opportunity to have its own Facebook page to further connect with potential customers by marketing its products through engaging and interesting digital posters and video ads.



Figure 6. Facebook Page of BeeMusa Enterprise

Shopee

The company will also use the online market sites in promoting the product “Zero waste as an alternative to single used plastic straws”. Shopee is Southeast Asia's and Taiwan's most popular e-commerce site. It is a platform designed for the region, launched in 2015, that offers clients a simple, secure, and quick online shopping experience through robust payment and fulfillment support.

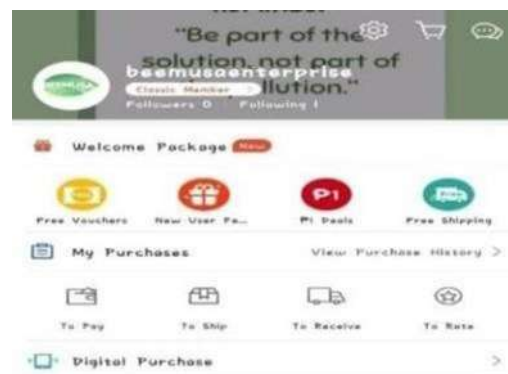


Figure 7. Shopee Account of BeeMusa Enterprise

Lazada

BEEMUSA Enterprise will also use the online e-market sites in promoting the “Zero waste as an alternative to single used plastic straws”. Lazada Group is an international e-commerce company and one of the largest e-commerce operators in Southeast Asia, with over 10,000 third-party sellers as of November 2014, and 50 million annual active

buyers as of September 2019. the company introduced LazMall on its platform to encourage its users to purchase from authentic brands. New services such as a 15-day return policy and next-day delivery options were also put in place.

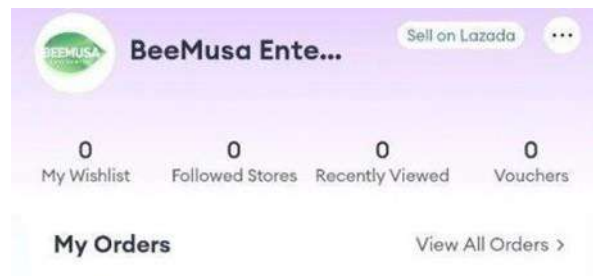


Figure 8. Lazada Account of BeeMusa Enterprise

Pricing Strategy

BeeMusa Enterprise uses Cost Plus as its pricing strategy which depends on the expenses of the primary raw material which is processed powdered banana leaf and food grade beeswax.

MARK UP DETERMINATION

	2023(9mos)	2024	2025	2026
PACKS PRODUCED AND SOLD	49608	88340	166665	
SELLING PRICE	30	30		
COST PER PACK OF STRAW	24.6			
MARK UP BASED OF COST				
MARK UP BASED OF COS				
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Table 5. Mark up Determination

Table 5 shows the mark up determination that the mark up percentage was taken based on overall production cost per Pack of BeeMusa organic straw.

Product Strategy

BEEMUSA Enterprise provide a product that is used mostly in cold beverages the product promotes eco-friendly that is made from organic materials this straw is made from banana leaf and beeswax this can be used by people owning a business including small and medium enterprises especially for cold beverages. 'Zero waste as an alternative to single used plastic straws' is an environmentally friendly product having a zero content of any plastic materials.

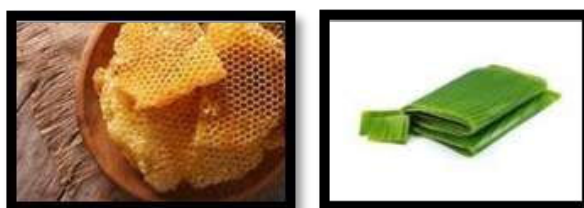


Figure 9. beeswax and Banana Leaf

BeeMusa Enterprise will be using mainly any kind of Beeswax and Banana Leaf as the main material in making the ‘Zero waste organic straw as an alternative to single used plastic straws” and making the product eco-friendly and one of the alternative single used straws in the market.



Figure 10. Actual Figure of Product

The financial performance is the basis of the sustainability of the company. Regardless of the amount of investment, the company would survive if its income surpassed its expenses at a comfortable margin. This section outlines the company’s capital requirements, projected financial performance for the next five years, and other financial data and ratios to assess its liquidity and solvency.

Major Assumption Used

1. The sales will star from the 4th month of the beginning year
2. Pack are slod within the year of production
3. All sales are made in cash
4. The selling price is fixed at P30.00 per pack, VAT inclusive
5. The salary increase is not included; it will be based on the workers evaluation.
6. The no. of workers will increase by 2 in year 3rd year and 5 workers for 4th year.
7. Expenses for the utilities are all part of the productioncost
8. Management will not have salaries for 5 years of the operation, their dividends will serve as their salaries.
9. The mark up of BeeMusa for five years is in ranges 6% - 58% based on cost.
10. The Fixed Assets will depreciate using straight-line method

SUMMARY

Measurement	Value	Decision
Payback Period	1 year and 3 months	Approved since it is earlier than 3 years
Net Present Value	P9,025,978.75	Approved since the NPV is a positive number, higher than decent one
Profitability Index	13.89	Approved since it is greater than 1
Internal Rate of Return	95.98%	Approved since it is higher than 15%

Table 6. Summary of Payback Period

Table 6 shows that after 1 year and 3 Months BeeMusa Enterprise got the payback period and got the approved decision since it is earlier than 3 years this summary proves the profitability of BeeMusa Enterprise.

The main beneficiaries of alternative organic straws of BeeMusa Enterprise Include the following: • Small Enterprises (i.e., Milk tea shops, or Restaurants) - the product will be used as an alternative organic drinking straw material for cold beverages.

Environment. Organic straws from powdered banana leaf and beeswax are an ecofriendly product that is made mainly of upcycle and organic materials like banana leaf; the product is a great help in conserving plastic. It also has beeswax, that protects the straw from soggy and good as a waterproofing agent.

Environmental Enthusiast. Organic straws from powdered banana leaf and beeswax are made from upcycle material like powdered banana leaf that comes with a natural green color that promotes people to be passionate about sustainable living and make environmentally responsible choices

Future Researchers. The feasibility project can help to expand the knowledge in building or starting a business and introduces the future research to a new idea about designing a product like the kind of Organic straws from powdered banana leaf and beeswax.

CONCLUSION AND FUTURE WORKS

This study and the enterprise proposed and developed an eco- friendly straw that made in processed powdered banana leaf. Since it is made of plant-based materials, using it doesn't produce any waste. BeeMusa straw, a natural straw is a single use straw that promotes zero waste to minimize the usage of single-use plastic. This type of business can provide an example for other enterprises or for everyone to adopt eco-friendly goods rather than polluting the environment and to minimize the usage plastic as both people and wildlife are harmed by plastic waste. Substitutes for single-use plastic straws have been developed by the Researchers to help the environment to reduce pollution.

The product will be sold by pack for ₱30 consisting of 10 pieces straws. The company will supply the businesses like milk tea shops, restaurant and shake vendor, around the company location in Barangay 171 Bagumbong North Caloocan City. For the 1st year of BeeMusa Enterprise production, 8 workers are needed for the daily capacity of the company. Each pack will be processed 1.59 minutes and can produced 212 packs a day to meet the supply each business needed.

An assessment of the whole feasibility study allows the executives, personnel, and employees who serve as assets to determine whether there are any investment options available. To search process and information is never been easy as it requires

patient and perseverance. To come up to the process and materials required to make the products are made easy as it is readily available on the market, making it more technologically and manufactory feasible. Moreover, the Researchers were able to acquire essential funds to ensure the financial viability of the business.

The Future works of this study and the enterprise will may be making a different or various sizes of BeeMusa straws for different kind of cold beverages. And a colourless straw can also be considered, by using the midrib of the banana leaf since the enterprise promotes an eco-friendly product. Instead of throwing away or wasting the mid rib part of the banana leaf, the enterprise will use it to produce an eco-friendly colourless straw.

Using the methods used and strategies of the company, this study comes up with the results which are the strategies in process, workers and materials used, total supply that connects in demand, in proper location and the financial statement. These results are aimed to have positive and clear data for the better of the future growth. It will be

helpful to determine if the product that we come up with will be more helpful to the environment and society. This will also determine if the company that the proponents built will be in the market for lifetime or if the customers will benefit and buy the product.

Manufacturing industry has a lot of processes with different strategies in it. Bermusa Enterprise came up with the natural process that even if it is a starting business, they managed to slowly reach the demands. The process that I have mentioned is having a lot of molders, divided for the 8 workers with division of works for each worker and the materials will be obtained from the suppliers. For banana leaf, it will be supplied by a farm that has hundreds, hundreds of banana trees. For the molders, it has 150 cavities each, and it can produce a lot if the process has a lot of molders. These techniques are summed up by the proponents based on their own experiences while doing the actual product. Next is for total supply that connects with the total demand annually. In a business, it has to be that your supply will meet the total demand otherwise, it is lower than the demand or vice versa, the business or the study is not feasible. In this case, the company has an annual forecast demand based on the frequency of agreement which the table below shows. So based on the survey conducted, the majority of the businesses are willing to buy packs of straws once a week. The capacity or the supply yearly will connect to the agreement. The possible supply yearly increases parallel to the demand. For the location, the enterprise chose wisely. They considered the possible advantages and disadvantages of choosing a location or an area. These factors are rates, measurements, and area including the laws and permits of the specific location. So these companies chose a location where the rates are low to lessen the cost of the company but it has big and wide space for production plus it is a commercial area. This area is located in a relocation where the rent is low and the permits and licenses are easy to apply. Including the costs for permits are low. Lastly, is the statement in the financial aspect. The business has experienced a lot of expense in production when it comes to the materials costs, labor costs and manufacturing overhead costs that are needed to be considered. For the costs in materials, the company decided to have a supplier online or near in the location. This includes the materials on the mixture and things that may be needed for mixing. The mixture has the main ingredients which are the banana leaf and beeswax, combining with the glycerin, cassava starch and vinegar. These are all organic and natural but the product is not edible. Beeswax for waterproofing, glycerin for the bio - plastic texture, cassava starch for the thickening agent of the mixture and vinegar for the balancing of the mixture. The combined mixture will serve as the content of the product, straw. The things that may be needed and included in the process are a set of measuring cups, plastic gloves, molders, stainless bowl and whisk. These are uses for mixing like measuring cups to measure the ingredients equally and balance to avoid rejects or defects when molding. Plastic gloves for safety and hygiene. The most important ones are the molders. Without these it will not become shaped as straw. Stainless bowl for combining the products and last but not the least whisk for mixing and combining them all. In terms of direct material, the company has no problem with it because it has low costs. It is also because of the suppliers that the company. Secondly, the labor costs, this was the 1st problem of the company. There had to be a lot of workers for the supply to meet the demand. So the computed number of workers for the first year of the company will be 8 and it is a lot for a starting business. These workers will consume a lot in the cost of the product, because it contains the benefits, salaries and 13th month pay. But the company minimized the costs. The management, which is also the founder and organization of the business, agreed that they will not have salaries for the first five years and their dividends on their investment will serve as their salaries. This will help the company to minimize the costs of labor. This may also lead to the company to focus more on the workers. For the other manufacturing overhead costs, these may include the utilities and rent expense. In utilities, these are the costs on the electricity, water consumption, drinking water, communication, gas like diesel and LPG. Electricity consumption is higher and costlier among all because the line and kilo wattage is for the businesses. Water consumption is directly connected in maynilad that's why it has lower cost monthly.

Drinking water is nearby so it is not hassle and does not cost too much. Gasses, the business will have diesel and LPG. Diesel for the transportation to deliver the products to the clients or customers. LPG is for heating the mixture while mixing it. These are all included in product costing. By these, the company arrives with the price which is 30 pesos per pack of straw consisting of 10 straws each pack. The results in sales are good and reasonable. It has a flow loss to income. Loss in the first years because it has a lot of costs in the first year but in the second year the company will be income but at a small amount it's not bad and in the following years will have income. It is good because only the first year is lost and the next year will become income. The ratios are higher than 1 and for the following years the flow is upwards. By these key concepts will determine if the business will be in good condition or bad in the forecasted 5 years. This will indicate that a feasibility study is feasible.

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REFERENCES

- World Bank Organization: Market Study for Philippines: Plastics Circularity Opportunities and Barriers
- Ateneo De Manila News: The Face of Plastic
- Nanang Eko Wahyuningtiyas, Heru Suryanto, (2018), Analysis of Biodegradation of Bioplastics Made of Cassava Starch
- N Hendrawati et al (2021), Biodegradable foam tray based on sago starch with beeswax as coating agent
- Department of Labor and Employment (2016), Wage order no. NCR – 22
- Department of Labor and Employment (2023), Daily Minimum Wages Rates
- Average Raise Percentage: What factors affect your raise?
- Nathalie Velasquez (2004), Caloocan City Ordinance No. 0386-04 PDF
- Energy saving trus (2015), At home with water 2 technical report
- Meralco (2023), January 2023 Rates updates
- Free Installation and activation