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# Estudo de viabilidade econômica para implantação de uma microindústria produtora de kombucha saborizada com maracujá da caatinga

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## Resumo

A Kombucha é uma bebida fermentada de origem chinesa produzida à partir da infusão de chá preto ou verde da planta *Camelia sinensis*, açúcar e uma cultura simbiótica conhecida como SCOBY. Após a fermentação, a bebida torna-se rica em nutrientes naturais com funções benéficas para a saúde como ácidos orgânicos, aminoácidos, vitamina C, polifenóis e substâncias antibióticas. O presente trabalho tem como objetivo realizar um estudo da viabilidade econômica de abertura de uma microindústria para produção de kombucha de chá preto saborizada com maracujá da caatinga. Para o desenvolvimento do estudo foi realizado um plano de negócios identificando as especificações de processos, equipamentos e análises de indicadores financeiros e econômicos. A avaliação dos investimentos foi realizada através dos métodos de taxa interna de retorno (TIR), taxa mínima de atratividade (TAM), valor presente líquido (VPL), payback simples e payback descontado. O investimento inicial para a produção de 2.000 litros de kombuchá aromatizado com maracujá da caatinga foi de R$ 187.199,78. Os indicadores econômicos obtidos resultaram em VPL de R$ 253.154,68, TIR de 22%, TAM de 13,34% a.a. e payback simples de 3,9 anos considerando vida útil de 10 anos. A TIR positiva reflete que o empreendimento é economicamente viável e rentável, possibilitando investimento e geração de renda para cooperativas e agricultores familiares.

**Palavras-chave:** Viabilidade econômica; kombuchá; *Passiflora cincinnata* Mast.; Payback.

# Economic feasibility study for the implementation of a micro-industry producing kombucha flavored with passion fruit from the caatinga.


## Abstract

Kombucha is a fermented beverage of Chinese origin produced from the infusion of black or green tea from the *Camelia sinensis* plant, sugar and a symbiotic culture known as SCOBY. After fermentation, the drink becomes rich in natural nutrients with functions that are beneficial to health such as organic acids, amino acids, vitamin C, polyphenols and antibiotic substances. The present work aims at carrying out a study of the economic feasibility of opening a micro-industry for the production of a black tea kombucha flavored with passion fruit from the caatinga. For the development of the study, a business plan was created identifying the specifications of the processes, equipment and analysis of financial and economic indicators were carried out. The evaluation of the investments was carried out using the internal rate of return (IRR), minimum attractiveness rate (TAM), net present value (NPV), simple *payback* and discounted *payback* methods. The initial investment for the production of 2,000 L of kombucha flavored with passion fruit from the caatinga was R$ 187,199.78. The economic indicators obtained resulted in NPV of R$ 253,154.68, IRR of 22%, TAM of 13.34% p.a. and simple *payback* of 3.9 years considering a useful life of 10 years. The positive IRR reflects that the enterprise is economically viable and profitable, making it possible to invest and generate income for cooperatives and family farmers.



**Keywords:** Economic feasibility; kombucha; *Passiflora cincinnata* Mast.; *Payback.*


## 1. Introduction

Kombucha is a sweet, bubbly and slightly acidic drink that has become popular in Brazil and all over the world due to the population's search for healthy foods with therapeutic effects (BISHOP et al., 2022; LIU et al., 2021; MARSOLA et al., 2021). Kombucha is produced using sweetened black tea or green tea (*Camellia Sinensis*), through fermentation promoted by the symbiotic association of yeasts (*Saccharomyces, Debaryomyces* and *Kluyveromyces* sp), acetic acid bacteria (*Acetobacter* and *Gluconobacter*) and some lactic acid bacteria (*Lactobacillus* and *Oenococcus* spp) called SCOBY (Symbiotic Consortium of Bacteria and Yeasts) (ABACI et al., 2022; JAKUBCZYK et al., 2022; BARBOSA et al., 2022). The yeasts during fermentation hydrolyze the sucrose into glucose and fructose, which will be metabolized into ethanol. Ethanol is oxidized by acetic bacteria producing acetic acid, which is responsible for the bitter taste of the beverage (WANG et al., 2022).

The chemical composition of kombucha is influenced by the type of SCOBY, type of substrate, type of tea, temperature, time and amount of oxygen (SILVA et al., 2021; MIRANDA et al., 2022). Any variation in these factors interferes with the chemical properties, sensory characteristics, biological activities and nutritional quality of kombucha (MIRANDA et al., 2022). During the fermentation process, organic acids (acetic, gluconic, glucuronic, citric, L-lactic, malic, tartaric, malonic, oxalic, succinic, pyruvic, usnic and D-saccharic-1,4-lactone acid (DSL), vitamins (C, $B_1$, $B_2$ and $B_{12}$), polyphenols (catechins, theaflavins and flavonoids),

minerals and enzymes (CHU; CHEN, 2006; ABACI et al., 2022; VILLARREAL-SOTO et al., 2018; BISHOP et al., 2022; KLAWPIYAPAMORNKUN et al., 2023) that confer consumer health benefits such as antioxidant, antimicrobial and anti-inflammatory activity (MORALES et al., 2023; GAGGÌA et al., 2019).

Brazil is a major producer and consumer of passion fruit. Passion fruit extracts have a great commercial value in the food, beverage, pharmaceutical and nutraceutical industries. *Passiflora* is widely studied for its anti-inflammatory, antioxidant, anxiolytic and cardiovascular protective effects, due to the presence of polyphenols (DUARTE et al., 2021). Caatinga passion fruit occurs frequently in the Brazilian biomes of the *cerrado* (states of Minas Gerais and Goiás) and the caatinga (states of Bahia and Pernambuco) (BIASOTO et al., 2021; ARAÚJO et al., 2018). The production of passion fruit is carried out by cooperatives of family farmers and traditional communities. These fruits will be used in different segments such as gastronomy, agro-industrial processing, cosmetic and food industry (ARAÚJO et al., 2019).

**Kombucha has become popular among consumers looking for a healthier lifestyle and looking for foods that have health benefits and can be added to their diet, as a substitute for soft drinks.** Therefore, the objective of this study is to evaluate the economic feasibility of the implementation of a micro-industry producing kombucha flavored with passion fruit from the caatinga.

## 2. Material and methods

For the development of this article, a business plan was created, through price quotation from at least 3 suppliers of equipment for micro-industry, identifying process and equipment specifications. Salary values were defined in accordance with Brazilian labor laws. Taxes were calculated taking into account Brazilian law and the specific rates of the state of Bahia. Investment evaluation was carried out through analysis of financial and economic indicators NPV, IRR and Payback.

### 2.1 Economic feasibility

According to Almeida et al. (2018), the development of the economic feasibility study is an important tool for new companies, as it grants the manager the opportunity to make the early decision to invest or not in a production, according to the profitability of this new business. Padoveze (2011) states that "an investment is characterized by being an expense not consumed immediately whose results will come from the future benefits of these expenses". In order to measure the potential return of the implementation of a kombucha factory with passion fruit from the caatinga, value quotations were made in companies that supply raw materials, equipment, reagents, glassware, PPE and cleaning material. In addition, a survey was carried out on the values of taxes, base salary, charges, energy, water, depreciation and

analysis of the physicochemical experiments for the production of kombucha with passion fruit from the caatinga.

### 2.2 Calculation of NPV, IRR and *Payback*

For the development of the economic feasibility study as proposed by Brandão et al. (2018), the economic indicators net present value (NPV), the internal rate of return (IRR) and the payback method considering a time of 10 years (T=10) were used.

Net present value, or NPV, is an instrument that brings the cash flows (positive and negative) of an investment project to zero. The initial amount invested is then added, with the minimum attractiveness rate (AMR). The NPV is an analysis of the investment and, through it, we are able to find out whether the investment project is viable.

The Internal Rate of Return, better known by the acronym IRR, is a percentage that can be used by a company or an investor to assess whether it is worth investing in a particular project or asset. IRR is a hypothetical discount rate, calculated from a cash flow projection (forecast of revenues generated by an investment over a certain period) when we consider that its Net Present Value (NPV) is zero.

*Payback* (or, in Portuguese, "return") is a calculation that allows one to know how long an investment takes to pay off. While simple *payback* does not consider the time value of money, discounted *payback* adds a discount rate to profits, bringing a more realistic scenario to the investor. Because there are discounts, the time to recover the investment will be longer than the simple *payback*.

In order to both calculate the NPV and find out the *discounted Payback*, the Minimum Attractiveness Rate (MAT) must be defined. The AHT is used as a parameter to define the minimum profitability that is expected to be obtained from the investment. We will use as a reference the current profitability of the Treasury Direct Selic, 13.34% p.a.

For the calculation of these indicators, Office Excel was used, and the IRR and NPV were obtained through the functions existing in the program itself, from the Cash Flow spreadsheet.

The following formulas were used to determine the economic feasibility factors (IRR, NPV, Simple *Payback* and *Discounted Payback*).

$$VPL = \sum_{j=1}^{n} \frac{FC_j}{(1+TMA)^j}$$

Where: j= period of each flow; FC= cash flow; AHR = minimum attractiveness rate and n = time period.

$$\sum_{i=1}^{n} \frac{FC_i}{(1+TIR)^i} - I_0 = 0$$

Where: FC = cash flows, n = final period of investment; i= period of each investment; and I0 = initial investment.

$$\text{Simple } \textit{Payback} = \frac{\text{Investment}}{\text{Cash Generation}}$$

$$\text{Discounted } \textit{Payback} = \frac{\text{Investment}}{\text{Discounted Balance}}$$

## 3. Results and discussion

For the realization of this study, data for the business plan was obtained through price quote in companies that supply equipment for micro-industries and this data also helped to build the cash flow spreadsheets.

### 3.1. Initial Investment

Table 1 shows the main items of the total initial investment for opening a kombucha factory with passion fruit from the caatinga, which are: utensils, equipment, documentation, PPE, administrative facilities and working capital.

**Table 01 - Initial investment items for the start of production of the fermented beverage kombucha with passion fruit from the caatinga.**

| Item | Value (R$) |
|---|---|
| Quarterly Shorts Shed Rent | 6,000.00 |
| Renovation of the industrial space | 10,000.00 |
| Industrial Equipment and Facilities | 92,052.74 |
| Administrative Equipment and Facilities | 12,110.59 |
| Packaging & Brand Development | 3,000.00 |
| PPE | 626.65 |
| Laboratory Supplies | 1,409.80 |
| Documentation for the composition of the enterprise | 2,000.00 |
| Working Capital | 60,000.00 |
| Subtotal | 187,199.78 |

The initial investment is the necessary resource for the acquisition of the company's fixed assets that will enable its operation. The capital required to make the initial investment feasible was R$ 187,199.78, raised through a bank loan with collateral and a monthly interest rate of 3%. The payment will be made in 120 months with fixed installments of R$ 1,807.61.

We highlight working capital, which consists of the minimum financial resource for the payment of initial fixed and variable costs until the receipt of the first payments related to the company's revenue. In this case, the amount necessary for 2 months of operation was incorporated into the cash flow, in an amount of R$ 60,000.00.

### 3.2. Fixed costs

Fixed costs are immutable over time, regardless of the company's productivity or revenue. They must have special attention from the manager in order to be controlled to achieve greater profitability of the business. The total monthly fixed expenses estimated for the proposed project account for R$ 14,916.39. According to Motta (1968), the cost of monthly production should be calculated by adding the direct and indirect costs. Fixed costs are separated into two categories: personnel cost and property cost.

### 3.3. Personnel Costs

The calculation of the salary for the employees was based on a workload of 20 hours per week, plus transportation, charges, vacations and proportional Christmas Bonus. The team will consist of a food engineer, a food technician, a technical assistant and a general services assistant. The values of net salaries and total costs are described in Table 2.

**Table 02 – Monthly fixed personnel costs.**

| Description | Quantity | Basic Salary (R$) | Charges (R$) | Total (R$) |
|---|---|---|---|---|
| Food Engineer | 1 | 4,859.77 | 1,115.25 | 5,975.02 |
| Food Technician | 1 | 2,069.17 | 924.21 | 3,010.21 |
| Technical Assistant | 1 | 1,302.00 | 448.82 | 1,750.82 |
| General Services | 1 | 1,302.00 | 448.82 | 1,750.82 |
| | | | Total | 9,476.66 |

### 3.4 Equity Costs

The maintenance and operation of the company generate recurring costs, which we will call fixed monthly expenses. In Table 3 below, we describe these expenses:**Table 03 – Monthly Fixed Expenses**

| Description | Quantity | Total (R$) |
|---|---|---|
| Rent | 1 | 2,000.00 |
| Loan Installment | 1 | 1,807.61 |
| Computer system | 1 | 300.00 |
| Accountant | 1 | 500.00 |
| Bank Fees | 1 | 89.00 |
| Internet | 1 | 50.00 |

| | | |
|---|---|---|
| Cleaning & Office Supplies | 1 | 500.00 |
| | Total | 5,246.61 |

## 3.5. Variable Costs

### 3.5.1. Production costs

The data related to the variable cost of kombucha production (Table 4) were estimated through the average of the prices obtained after a survey with suppliers. The production described totals the monthly volume of 2,000 liters of Kombucha, requiring one fermentation per week in 500-liter fermenters.

**Table 04 – Variable direct cost related to the monthly production of Kombucha with passion fruit from the caatinga**

| 1st Stage: Tea Preparation | | | | |
|---|---|---|---|---|
| Description | Unit | Quantity | Unit value (R$) | Total Value (R$) |
| Water | $m^3$ | 122 | 24.79 | 3,024.38 |
| Black tea | Kg | 10 | 42.44 | 446.07 |
| Crystal Sugar | Kg | 160 | 3.85 | 616.00 |
| Subtotal | | | | 4,086.45 |
| 2nd Stage: Fermentation and Analysis (Physical chemistry) | | | | |
| Description | Unit | Quantity | Unit value (R$) | Total Value (R$) |
| Passion fruit from the caatinga | Kg | 88 | 4.12 | 362.56 |
| SCOBY + Starter | L | 90 | 320 | 960 |
| Buffer solution (4) e (7) | L | 1 | 106.79 | 106.79 |
| Fnolphthalein | L | 1 | 32.00 | 32.00 |
| Sodium hydroxide | L | 1 | 22.74 | 22.74 |
| Subtotal | | | | 1,484.09 |
| 3rd Stage: Labelling and packaging | | | | |
| Description | Unit | Quantity | Unit value (R$) | Total Value (R$) |
| Bottles with caps (350 mL) | Units | 5,715 | 1.20 | 10,858.50 |
| Labels | Units | 5,715 | 0.33 | 1,885.95 |
| Subtotal | | | | 12,744.45 |
| 4th Stage: Electricity Expenses | | | | |
| Description | Unit | Quantity | Unit value (R$) | Total Value (R$) |
| Electrical energy | KW.h | 4,400 | 0.96 | 4,224.00 |
| Subtotal | | | | 4,224.00 |
| Total | | | | 22,538.99 |

Therefore, using the maximum installed manufacturing capacity, it is possible to produce a total of 5,715 bottles of the product monthly, requiring a direct investment in the order of R$ 22,538.99.

### 3.5.2. Other variable costs

As a result of the sale of the product, other variable costs arise that need to be considered for the calculation of the net profit margin. Considering the total sale of production in cash mode, we have two more variable costs, according to Table 5.

**Table 05 - Other Variable Costs**

| Description | Aliquot | Base | Total |
|---|---|---|---|
| National Tax | 4.5% | 45,720.00 | 2,057.40 |
| Freight | 5% | 45,720.00 | 2,286.00 |
| | | Total | 4,343.40 |

The National Tax has a rate of 4.5% in the case of accumulated annual revenues of up to R$ 180,000.00. Shipping varies according to the geographic location of the sale and the acquisition volume of each customer, with the percentage of 5% being a projection.

## 3.5.3. Pricing

To establish the final sale price, we will use a simple methodology of cost apportionment and definition of market markup. It is worth mentioning that the total monthly production of the installed capacity is 5,715 bottles. Therefore, we must find the unit cost of R$ 6.51, adding up all the costs presented so far and dividing by the total number of bottles produced, shown in Table 6.

**Table 06 - Price Formation**

| Description | R$ | Per bottle (R$) |
|---|---|---|
| Fixed cost | 14,723.27 | 2.57 |
| Variable Cost | 22,538.99 | 3.94 |
| | Total | 6.51 |

Based on research carried out with beverage distributors and other points of sale, we found similar products sold at a final price of R$ 9.00 to R$ 12.00. Considering that the retail markup for beverages is 20-25%, we set the wholesale price at $8.00. With this wholesale price, our product would be sold in markets and distributors for prices between R$ 9.60 and R$ 10.00. Considering the price set and the total sale of the units produced, we reached a turnover of R$ 45,720.00.

Revenue = 5,715 Product Units x R$ 8.00

Revenue = R$ 45,720.00

### 3.5.4. Net Income

Net Income is a company's income determined through the difference between total revenue and total cost. In view of all the data presented, we have a Net Profit forecast for the operation following the formula:

NI = Billing - (Fixed costs + variable costs + other variable costs)

NI = 45,720.00 - (14,723.27 +22,538.99+4,343.40)

MI = 45,720.00 - (41,605.66)

NI = R$ 4,114.34

Depreciation was the total value of fixed assets depreciated at an annual fixed rate of 1%. A Corporate Income Tax rate of 0.54% was levied on the profit, according to the corporate income tax table of the National Tax.

**Table 07 – Cash flow for a kombucha micro-industry with passion fruit from the caatinga.**

| Item (R$) | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Revenue | - | 187,199.78 | 187,199.78 | 187,199.78 | 187,199.78 | 187,199,.78 | 187,199.78 | 187,199.78 | 187,199.78 | 187,199.78 | 187,199.78 |
| Working capital | - | 60,000.00 | 60,000.00 | 60,000.00 | 60,000,00 | 60,000.00 | 60,0000.00 | 60,000.00 | 60,000.00 | 60,000.00 | 60,000.00 |
| Sales | - | 548,640.00 | 548,640.00 | 548,640.00 | 548,640.00 | 548,640.00 | 548,640.00 | 548,640.00 | 548,640.00 | 548,640.00 | 548,640.00 |
| Total Costs | - | 499,267.92 | 499,267.92 | 499,267.92 | 499,267.92 | 499,267.92 | 499,267.92 | 499,267.92 | 499,267.92 | 499,267.92 | 499,267.92 |
| Depreciation | - | 1,041.63 | 1,041.63 | 1,041.63 | 1,041.63 | 1,041.63 | 1,041.63 | 1,041.63 | 1,041.63 | 1,041.63 | 1,041.63 |
| Taxable income | - | 117,952.08 | 117,952.08 | 117,952.08 | 117,952.08 | 117,952.08 | 117,952.08 | 117,952.08 | 117,952.08 | 117,952.08 | 117,952.08 |
| Income tax | - | 636.94 | 636.94 | 636,94 | 636.94 | 636.94 | 636.94 | 636.94 | 636.94 | 636.94 | 636.94 |
| Cash Generation | - | 47,693.51 | 47,693.51 | 47,693.51 | 47,693.51 | 47,693.51 | 47,693.51 | 47,693.51 | 47,693.51 | 47,693.51 | 47,693.51 |
| Investment | 187,199.78 | | | | | | | | | | |
| Availability (R$) | -187,199.78 | -139,506.27 | -91,812.76 | -44,119.25 | 3.574,26 | 51,267.76 | 98.961,27 | 146,654.78 | 194,348.29 | 242,041.80 | 289,735.31 |
| Discounted Flow | -187,199.78 | 42,080.03 | 37,127.26 | 32,757.42 | 28.901,90 | 25,500.18 | 22.498,84 | 19,850.75 | 17,514.33 | 15,452.91 | 13,634.12 |
| Discounted Balance | -187,199.78 | -145,119.75 | -107,992.49 | -75,235.07 | -46.333,17 | -20,832.99 | 1.665,85 | 21,516.59 | 39,030.93 | 54,483.84 | 68,117.96 |

The profitability indicators obtained for the kombucha industry with passion fruit from the caatinga are shown in Table 8.

**Table 08 - Indicators of economic viability of a kombucha industry with passion fruit from the caatinga.**

| Description | Value |
|---|---|
| IRR | 22% |

| | |
|---|---|
| NPV | R$ 253,154.68 |
| Simple Payback | 3.9 years |
| Discounted Payback | 5.9 years |

The net present value (NPV) for the kombucha industry with passion fruit from the caatinga was R$ 253,154.68, the positive NPV reflects that the project is economically viable and profitable, making the investment possible.

The internal rate of return (IRR) was 22%, higher than the minimum attractiveness rate (TAM) considered at 13.34% p.a., reaffirming the possibility of carrying out the project. Regarding the simple payback, the return on capital will happen around 3.9 years.

Using as a reference the cash flow constructed and presented and the formulas mentioned, we reach the economic feasibility indexes that attest to the feasibility of the Kombucha micro-industry project.

## 4. Conclusion

In this study, a business plan was carried out to verify the forecasts to open a micro-industry of kombucha flavored with passion fruit from the caatinga. The specific objective of the study was achieved, as a positive result of NPV R$ 253,154.68 and a simple *payback* of 4 years was obtained, making the opening of the kombucha micro-industry viable. In the study, the quantity of kombucha produced per month ended up being a limiting factor in generating a greater profit, since the micro-industry could produce a larger quantity than was proposed. For future studies, it is suggested to carry out a business plan integrating new flavors and increasing the quantity of kombucha produced per month, in order to verify the possibility of reducing costs in the production of the kombucha unit and to achieve a greater profit. The opening of a kombucha micro-industry will favor the exploration and valorization of the native vegetation of the Bahia semi-arid biome and family farming, through the use of passion fruit from the caatinga.

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## 7. Conflict of interest

The authors declare that they have no conflict of interest.

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