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РАСЧЕТ СЕБЕСТОИМОСТИ РАЗРАБОТАННОГО ФУНКЦИОНАЛЬНОГО НАПИТКА НА ОСНОВЕ ЧАЯ МАТЧА

CALCULATION OF THE COST OF THE DEVELOPED FUNCTIONAL DRINK BASED ON MATCHA TEA

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Аннотация

Целью работы является расчет себестоимости разработанного функционального напитка на основе чая мачта. Матча– японский порошковый чай зеленого цвета. На первом этапе производиться оценка общего объёма капиталовложений: суммируются цены на оборудование и монтаж. Основной этап – расчет себестоимости разработанного функционального напитка на основе чая матча. Для получения показателя себестоимости рассчитываются затраты на сырье, тару и упаковку за год. Далее рассчитывается величина затрат на воду для различных производственных нужд, а также потребляемая оборудованием электроэнергия. На следующем этапе производиться расчет заработной платы персонала, которая состоит из основной и дополнительной заработной платы рабочих предприятия. Расчет производиться относительно таких понятий как: фонд рабочего времени, баланс рабочего времени. Были рассчитаны расходы на заработную плату, приходящиеся на 1 л готовой продукции. Важным было учесть обязательные социальные платежи, отчисления на социальное страхование. Далее производился расчет величины амортизационных отчислений. Один из важнейших показателей для расчета себестоимости – арендная плата. Предполагается аренда земли с находящимся на ней производственным помещением. Далее рассчитывался показатель – иные затраты. Эти затраты ориентировочно принимались равными 2% от стоимости сырья. Выявлено значение производственной себестоимости продукции. Полная себестоимость продукции рассчитывалась как сумма производственной себестоимости и, найденных ранее, внепроизводственных расходов. Структура полной себестоимости на различный объём напитка рассчитана и представлена в табличных данных. Далее определялось значение рентабельности готового продукта. Кроме того, была определена эффективность производства напитка чая матча на основе оценки срока окупаемости. По результатам выяснилось, что предприятие окупиться менее через 4 года. Расчет показал, что осуществление инвестиционного проекта целесообразно. Положительное значение накопленных денежных потоков означает появление у нас дополнительных возможностей. В силу того, что данный инвестиционный проект финансируется за счет заемных средств был произведен расчет величины денежного дохода, который фирма может направить на погашение займа и выплату процентов по кредиту. В результате технико-экономического обоснования проекта были подсчитаны следующие величины: себестоимость годовой готовой продукции 14600466 руб.; отпускная цена предприятия годовой готовой продукции 21019700 руб., или 57,5 руб. за одну бутылку напитка объемом 500 мл; чистая прибыль предприятия за год 6419230 руб.; затраты на 1 руб. товарной

продукции – 0,80 руб. Таким образом, разработанный проект можно оценить как эффективный. Производимый продукт является функциональным напитком, содержащим витамины, минералы, антиоксиданты. В силу полезности напитка, он будет востребован среди потребителей. Кроме того, рентабельность напитка составляет 16%, что говорит об эффективности предприятия.

Ключевые слова: себестоимость, функциональный напиток, чай матча, рентабельность, капиталовложения, сырье, оборудование, отпускная цена.

Abstract

The purpose of the work is to calculate the cost of the developed functional drink based on mast tea. Matcha is a Japanese powdered green tea. At the first stage, the total investment volume is estimated: the prices for equipment and installation are summed up. The main stage is the calculation of the cost of the developed functional drink based on matcha tea. To obtain the cost index, the costs of raw materials, containers and packaging for the year are calculated. Next, the amount of water costs for various production needs is calculated, as well as the electricity consumed by the equipment. At the next stage, staff salaries are calculated, which consists of the main and additional wages of the workers of the enterprise. The calculation is made with respect to such concepts as: working time fund, working time balance. The payroll expenses per 1 liter of finished products were calculated. It was important to take into account mandatory social payments, social insurance contributions. Next, the amount of depreciation deductions was calculated. One of the most important indicators for calculating the cost price is rent. It is supposed to lease land with a production facility located on it. Then the indicator was calculated – other costs. These costs were approximately assumed to be equal to 2% of the cost of raw materials. The value of the production cost of products is revealed. The total cost of production was calculated as the sum of the production cost and, previously found, non-production costs. The structure of the total cost for a different volume of the drink is calculated and presented in tabular data. Next, the value of the profitability of the finished product was determined. In addition, the efficiency of the production of matcha tea drink was determined based on the assessment of the payback period. According to the results, it turned out that the company will pay off in less than 4 years. The calculation showed that the implementation of the investment project is expedient. The positive value of accumulated cash flows means that we have additional opportunities. Due to the fact that this investment project is financed by borrowed funds, the amount of cash income that the firm can use to repay the loan and pay interest on the loan was calculated. As a result of the feasibility study of the project, the following values were calculated: the cost of the annual finished product of 14,600,466 rubles; the selling price of the enterprise of the annual finished product of 2101,9700 rubles, or 57.5 rubles for one bottle of a 500 ml drink; the net profit of the enterprise for the year of 6419,230 rubles; the cost of 1 ruble of marketable products – 0.80 rubles. Thus, the developed project can be evaluated as effective. The product produced is a functional drink containing vitamins, minerals, and antioxidants. Due to the usefulness of the drink, it will be in demand among consumers. In addition, the profitability of the drink is 16%, which indicates the efficiency of the enterprise.

Key words: *cost price, functional drink, matcha tea, profitability, capital investment, raw materials, equipment, selling price.*

Introduction

Previously, a technological scheme for the production of a non-alcoholic functional drink based on matcha tea was developed. Matcha powder is a raw material made from the dried leaves of special green tea. Matcha powder is brewed into an emerald green drink. The produced product will be in demand among consumers due to the many useful properties that make up the drink. It is important to note that the composition of the dry powder includes vitamins and minerals, the main of which are: magnesium, fluorine, calcium, potassium.

Matcha tea contains antioxidants that have a positive effect on the human body. Scientists have found that matcha contains 100 times more epigallocatechin than any other tea. Thus, the use of the drink contributes to: increasing immunity, improving metabolism, strengthening the cardiovascular system, improving the functioning of the digestive tract.

The cost of production allows you to determine the quality of the product and its effectiveness. The cost indicator is calculated by any enterprise. The fact is that the profitability of the enterprise, as well as the profitability of the enterprise, is evaluated relative to the cost indicator. Using the cost indicator, the selling price of the product is formed. The price, in turn, determines the position of the enterprise in the market.

Materials, models, experiments and methods

Determining the total investment

To determine the total amount of capital investment, it is necessary to sum up the costs of purchasing equipment, as well as its installation and commissioning. The cost of electrical power equipment and instrumentation.

The main equipment used for the production are a syrup vat, a blending vat, a heat exchanger, a filter, a pasteurizer, a saturator, a blowing machine, a bottling line.

According to the calculation, the cost of purchasing equipment is:

$$C_o = 1054840 \text{ руб.}$$

Costs for commissioning of the CC are accepted in the amount of 10% of the cost of the equipment:

$$CC = 0{,}1 \cdot 1054840 = 105484 \text{ rub.}$$

The cost of instrumentation is taken at a rate of 4% of the cost of the main equipment:

$$CI = 0{,}04 \cdot 1054840 = 42193{,}6 \text{ rub.}$$

Determination of the cost of manufactured products

The cost indicator shows to what extent raw materials, necessary materials, energy, labor are used and how economically materials and raw materials are spent. Calculations of the annual production of a functional drink are presented in table 1.

Table 1 - Calculations of the annual production of a functional drink

Name of product	Shift production rate, l	Number of work shifts per year	Annual production volume, l
Functional drink	1480	247	365560

The cost of the finished product is determined by the following costing items:

Raw materials and basic materials make up a large part of the total cost of the product. In the production of a matcha-based drink, the cost of raw materials is the sum of the costs of raw materials, according to the recipe.

The cost of raw materials and auxiliary materials for the production of a functional drink are presented in tables 2 and 3.

Table 2 - The cost of raw materials

Name of raw materials	Price for 1 kg, rub.	Consumption rate for 1 liter of products, kg	Demand for annual volume, kg	Costs for the annual volume, rub.
Matcha tea	1800	0.004	1462.24	2632032
Sugar	45	0.028	10235.68	460605.6
Lime juice	820	0.006	2193.36	1798555.2
Ascorbic acid	380	0.0002	73.112	27728.56
Lemon acid	475	0.0001	36.556	17364.1
Sodium bicarbonate	62	0.00011	40.2116	2493.1
Potassium sorbate	213	0.0006	219.336	46.718
Sodium benzonate	230	0.00012	43.8672	10089.45
Water	0.02876	0.961	351303.16	10103.47

Flavoring	996	0.0002	73.112	72819.55
Dye	3114	0.0002	73.112	227670.76
TOTAL	-	-	-	5259507.67

Table 3 - Cost of auxiliary materials

Name of materials	price, rub.	Unit	Consumption rate per 1 liter of products	Need per year volume	Cost per year, rub.
Preform	2.9	PC.	2	731120	2120248
Label	3	PC.	2	731120	2193360
Lids	1	PC.	2	731120	731120
TOTAL	-	-	-	-	5044728

The cost of raw materials, purchased products, containers and packaging for the production of a functional drink is 10,304,235.67 rubles.

Let's calculate the cost of water for various production needs.

According to SNIP, the cost of 1 m ^{3} of water is 28.76 rubles. Water costs at various stages of the technological process are presented in Table 4.

Table 4 - Water costs at various stages of the technological process

Name of product	Annual production volume, l	Water for 1 m3 -28.76 rubles.		
		Consumption rate for 1480 l, m ^{3}	Demand for annual volume, m ^{3}	Costs for the annual volume, thousand rubles.
Expenses for household and drinking needs	365560	0.9	222.3	6.39
Cost of washing equipment, pipelines and floors per shift	365560	21.6	5335.2	153.4
TOTAL	-	-	-	159.8

Let's find the value of the cost of all the necessary raw materials based on 1 liter of output C_r (rubles) according to the formula:

$$C_r = \frac{C_a}{Va}, \quad (1)$$

where C_a - the cost of the annual production volume;

Va - annual production volume, kg.

$$C_r = \frac{10304235{,}67}{365560} = 28{,}18 \text{ rub} \setminus \text{l}$$

Transport and procurement costs. Transportation costs per 1 liter of manufactured products Ctp (rubles) are 8% of the cost of raw materials and basic materials.

$$C_{\text{тр}} = 0{,}08 \cdot Cr \quad (2)$$

$$C_{\text{тр}} = 0{,}08 \cdot 14{,}38 = 1{,}15 \text{ rub}$$

According to calculations, transport and procurement costs amount to 1.15 rubles, which, in terms of annual volume, is 420.540 thousand rubles.

Energy costs. The cost of 1 kW / h according to SNIP is 4.26 rubles. The cost of electricity is summarized in Table 5. Thus, the cost of electricity C $_e$ (rub.) per day is: 1297.17.

Table 5 - Electricity costs

Type of equipment	Electricity for 1 kW - 4.26 rubles.		
	Installed power, kW	Operating time per cycle, h	Electricity consumption, kWh
Syrup vat	12	0.66	7.92
Heat exchanger	7.9	7.4	58.46

Blending vat	0.8	2	1.6
Filter	4.25	7.4	31.45
Pasteurizer	0.18	7.4	1.332
Saturator	8	7.4	59.2
Filling monoblock	0.55	7.4	4.07
Semiautomatic blower	12.56	7.4	92.944
Collection measurer 200l	0	-	-
Collection measurer 2l	0	-	-
Packer	6	7.4	44.4
Dispenser	0.04	0.16	0.0064
Brewing vat	12	0.26	3.12
TOTAL	-	-	304.5024

In terms of the annual volume of output, the cost of electricity is 320,403 rubles.

Staff salaries. It consists of the basic and additional wages of the company's personnel. In this case, there is no additional salary, because the company does not work on night shifts and on public holidays.

Balance of working hours – the number of days of work of one worker per year. The working time fund is equal to the number of calendar days in a year, excluding weekends and holidays – 247 days.

Table 6 shows the balance of working time per worker per year.

Table 6 - Balance of working time per worker per year

The name of indicators	Amount of days
Calendar fund of working time, days	365
Non-working days, total	118
Including: - weekend - holidays	 14 104
Nominal working time fund	247
Planned all-day absenteeism, total: Including: - regular and additional vacation - maternity leave - absenteeism due to illness	 28 547 15

The calculation of the number and annual payroll of time workers was also made. The main production consists of the following workers: raw material acceptance worker, machine and equipment adjuster, drink preparation process operator, bottling operator, packer operator. The annual wage fund is 1493.84 thousand rubles.

Auxiliary production: locksmith, transporter, finished product controller, loader driver, electrician. The annual wage fund is 1372.92 thousand rubles.

Table 7 presents the calculation of the number and annual payroll of administrative and managerial personnel.

Table 7 - Calculation of the number and annual payroll of administrative and managerial personnel

Job title	Number of regular meals, people	Monthly salary, thousand rubles	Basic fund s/n, thousand rubles	Add. salary fund, thousand rubles	Annual payroll fund, thousand rubles
1	2	3	4	5	6
Leaders					
Gen. director	1	95	1140	680	1820
Ch. engineer	1	60	720	430	1150
Ch. accountant	1	45	540	324	864
Ch. of marketing department	1	65	780	460	1240

Specialists					
Chief technologist	1	50	600	360	960
Microbiologist	1	35	420	250	670
Economist	1	thirty	360	216	576
Engineer	1	37	444	265	709
Employees					
Secretary	1	20	240	140	380
MOS					
Cleaning	1	15	180	106.6	286.6
Total	1 0	-	-	-	8655.6

Let's calculate the wage costs per 1 liter of finished products:

$$Cw = \frac{\sum Cw}{n \cdot Q}, \quad (3)$$

where ∑Cw = 11522360 rub. – the amount of wages of all employees of the enterprise for the year;

n \u003d 247 day – the number of working days in a year;

Q \u003d 1480 l – the volume of products produced per day, l.

$$Cw = \frac{11522360}{247 \cdot 1480} = 31{,}51 \text{ rub.}$$

For the production of 1 liter of the drink, work is required, paid in the amount of 31.61 rubles.

Mandatory social payments. Social insurance contributions are accepted equal to 30% of the amount of the wage fund:

$$C\,mcp = 0{,}3 \cdot 31{,}61 = 9{,}45 \text{ rub.} \quad 4)$$

In the year of deductions for social insurance is 3454.542 thousand rubles.

Depreciation of fixed capital. Depreciation represents, in monetary terms, the depreciation of fixed assets in the course of their productive functioning.

Based on the data obtained, the useful life of the equipment is from 7 to 10 years. The amount of depreciation deductions for 1 kg of manufactured products D (rubles) will be:

$$D = \frac{C_{eq}}{\tau \cdot ma}, \quad (5)$$

where τ is the useful life, we take 10 years;

m_a - the number of products manufactured per year, l.

$$D = \frac{154790\,0}{10 \cdot 365560} = 0{,}42 \text{ rub.}$$

Rent. It is supposed to lease the land with the industrial premises located on it. Given that the total production area is 250 m^2, and the rent for 1 $м^2$ − 800 rubles, let's estimate the cost of renting the entire production facility:

$$R = 250 \cdot 800 = 200000 \text{ rub.}$$

Then 6.5652 rubles per liter per liter of production.

Other costs. Includes all costs not included above. These costs are approximately taken equal to 2% of the cost of raw materials:

$$Co = 0{,}02 \cdot 14{,}38 = 0{,}2876 \text{ rub.}$$

Let's find the production cost of products as the sum of the listed costs and other production costs:

$$C\,prod = C_r + C_{тр} + C_e + C_w + C_{mcp} + D + R + Co \quad (6)$$

$$C\,prod = 28{,}18 + 1{,}15 + 31{,}51 + 9{,}45 + 0{,}42 + 6{,}5652 + 0{,}2876 + 0.87 = 73.4$$

Non-manufacturing expenses are allowed to be accepted in the amount of 2% of the production cost of products.

$$E = 0{,}02 \cdot 73{,}43 = 1{,}46 \text{ rub \ kg}$$

The total cost of production is found as the sum of the production cost and non-manufacturing costs:

$$C_t = Cp + E \quad (7)$$

$$Ct = 78{,}43 + 1{,}46 = 79{,}89$$

Thus, the total cost of 1 liter of products is 79.89 rubles.

The structure of the total cost of 500 ml of the drink is presented in table 8.

Table 8 - The structure of the total cost of 500 ml of drink

The name of the costs that make up the total cost per 500 ml of drink	The amount of costs, rub.
Raw materials and basic materials	7.19
Auxiliary materials	6.9
Fare	0.57
Salary	15.75
Social security contributions	4.72
Depreciation deductions	0.21
Rent	3.2826 _
Electricity	0.4335 _
Other operating expenses	0.143
non-manufacturing expenses	0.73
TOTAL	39.94

Profitability and payback period of investments

Profitability shows the efficiency of the resources used.

Profitability is defined as the ratio of profit to market price.

$$P = \frac{Pr - C_t}{Pr}, \quad (8)$$

where Pr \u003d 95 rubles. – the expected selling price of 1 bottle of drink with a volume of 1 liter.

$$P = \frac{95 - 79{,}89}{95} \cdot 100\% = 16\%$$

The selling price for one bottle of the drink was 111.2 rubles. The price of competitors ranges from 90 to 120 rubles.

The selling price for 0.5 of a drink is presented in table 9.

Table 9 - Selling price for 0.5 drink

Product output volume, l	Sebes units of production, rub.	Product profitability		Manufactured price, rub.	VAT		Selling price of the enterprise per unit. products
		%	rub.		%	rub.	
	3	4	5	6	7	8	
0.5	39.94	20	7.98	47.92	20	9.58	57.5

To determine the effectiveness of the production of a drink based on matcha tea, it is necessary to determine the payback period – the time from the start of the implementation of the investment project to the moment when the initial investment and other costs associated with the implementation of the project are covered by the total results of its implementation.

Net present value for n years of project implementation is calculated by the formula:

$$NPV = C + (C \cdot r) - P, \quad (9)$$

where *NPV* – net present value, rub.;
C = t.rub. – total production costs;
P is the net profit of the organization for the year [32].

$$P = Pr - Ct \quad (10)$$

$$P = (57,5-39,94) \cdot 365560 = 6419233$$

r – in the case of bank lending, the bank loan rate (VTB-24 Bank): *r* = 0.11.

The payback period is determined by the gradual calculation of NPV for the years of operation of the organization. The year in which NPV becomes zero will be the last payback year:

n =1:

$$NPV = 163666,941 + (16366,941 \cdot 0,11) - 64,19,23 = 11784,071$$

n =2:

$$NPV = 11784,071 + (11784,071 \cdot 0,11) - 64,19,23 = 6621,12$$

n =3:

$$NPV = 6621,12 + (6621,12 \cdot 0,11) - 64,19,23 = 930,21$$

n =4:

$$NPV = 930,21 + (930,21 \cdot 0,11) - 64,19,23 = -5386,7$$

Thus, capital investments will pay off in less than 4 years.

The calculation showed that the implementation of the investment project is expedient. The positive value of the accumulated cash flows means that we have additional opportunities (additional funds) that we can invest in the development of the project.

This investment project is financed by borrowed funds. In this case, it is necessary to determine how much cash income the company can use to repay the loan and pay interest on the loan. The scheme of cash flows is summarized in table 10.

Table 10 - Scheme of cash flows

Years	Investment costs(-), Cash income (+)	Present value of investments (-) and cash income (+), based on 11% per annum	Present value for the implementation of the investment project
0	-16366.941	-16366.941	-16366.941
1	6419.23	5713.1147	-10653.82
2	6419.23	5084.67	-5569.15
3	6419.23	4525.36	-1043.79
4	6419.23	4027.58	2983.79

Estimation of the payback period of a technical solution

This is the period for which the initial costs of the project will pay off at the expense of income discounted at the interest rate (rate of return) at the current time.

Our initial costs for the implementation of the technical solution will amount to 16366.941 thousand rubles, the annual income is 6419.23 thousand rubles. The economically viable project implementation period is assumed to be 5 years. Discount rate 11%. According to the calculations summarized in the table, it can be seen that the project pays off in 4 years. As a result, it is clear that production will pay off quickly.

As a result of the feasibility study of the project, the following values were calculated: the cost of the annual finished product is 14,600,466 rubles; the selling price of the enterprise for the annual finished product is 21,019,700 rubles, or 57.5 rubles. for one bottle of drink with a volume of 500 ml; net profit of the enterprise for the year 6419230 rubles; costs for 1 rub. marketable products – 0.80 rubles.

Figure 1. The structure of the full cost

Research results and their discussion

The produced product is a functional drink containing vitamins, minerals, antioxidants, which have a positive effect on the human body. Due to the usefulness of the drink, it will be in demand among consumers seeking a healthy lifestyle, or those who want to improve their health. In addition, the price of the drink in the commodity market is lower than the prices of competitors, which is an important factor for consumers.

The enterprise is efficient due to the payback period of 4 years, which is a good result for food enterprises. In addition, the profitability of the drink is 16%. All this gives reason to believe that the production of the drink is efficient.

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