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MARKETING INNOVATION IN THE MANUFACTURING OF STONE-GRINDING PRODUCTS

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Abstract

The introduction of innovative technologies in the extraction of basalt helps to increase the efficiency of the mining enterprise. Volyn Basalt has its own features in terms of blockage and fracture. Studies of basaltic outcrops in the conditions of the Rafalovsky and Berestovetsky quarries showed their high fissure, clearly expressed separately, limited by vertical and horizontal fissures. Such characteristics affect the technology of stone extraction and processing. The physical, mechanical and chemical properties of the basalts of Private Joint Stock Company (PJSC) "Rafalovsky Quarry" allow it to be used for the organization of production of types of products. It is advisable to organize the production of stone, which will allow you to make a cloth of super-thin basalt fiber. The economic substantiation of the effectiveness of such an innovation was carried out on the example of the enterprise of PJSC "Rafalovsky Quarry" on the basis of traditional methods of project analysis. In order to ensure the successful functioning of the enterprise in the production of new products, it is necessary to create a marketing service, as an important component of the structure of the enterprise.

Introduction

The use of innovative products and technologies has a significant impact on improving the production and economic activity of the enterprise, increasing its competitiveness and increasing profits and the rational organization of the innovation process is the key to maintaining a stable market position and further functioning and development. Development, production and sale of innovative products in the production of stone-crushed stone products require the introduction of specific marketing and management measures.

One of the innovative areas for Rivne mining companies is the production of basalt wool. It is by far the highest quality and most demanded thermal insulation product. Advantages of mineral wool insulation made on the basis of basalt fiber, developers explain their high thermal and sound insulation performance, as well as flammability [1].

The production of such products in an individual enterprise is economically feasible, but requires improvement of organizational activity. An important aspect is to take into account the features of the basalt rocks extracted by the enterprise.

Volyn basalts attract researchers with their unique mineralogical and chemical composition.

Their isotopic age according to the potassium-argon method is 510-598 million years.

They are represented by two varieties. Aphonite basalts are black and dark gray aphonite rocks. Basically, it is plugonite basalt. Its mineral composition: plagioclase - 36%, pyroxene - 33%, glass - 19%, palagonite - 6%, mineral - 6%. These basalts are exposed in the quarries of the villages of Berestovtsy, Yanova Dolina, Ivanchi, Polyssia and others. Almond-shaped basalts are a greenish-gray fine-grained rock with a large number of tonsils up to 15 mm in size. Mineral composition: plagioclase, ore mineral (magnetite, ilmenite), apatite, volcanic glass. The main eruptions are in the Styr river basin. The density of the rock and the chemical composition of the basic basalts are presented in table. 1 (weight percentage).

Table 1

Chemical composition of basic basalts by quarries

The compositions of chemical elements,%	Detection Places	
	Hodosy, Gutvin, Yanova Dolina, Midsk	Berestovtsi, Yanova Dolina (quarry №2)
SiO_2	45,04	49,5
TiO_2	2,54	2,85
Al_2O_3	14,3	12,79
Fe_2O_3	6,03	3,36
FeO	6,46	10,63
MnO	0,4	0,21
MgO	8,47	6,19
CaO	6,58	9,38
Na_2O	2,42	2,78
K_2O	0,48	2,05
P_2O_5	0,17	0,57
SO_3	0,3	0,2
CuO	0,03-1,2	0,22
H_2O	0,72	0,8
Інші	1,88	2,41

To destroy the ore body and the subsequent extraction of minerals, it is necessary to expend a significant amount of energy. The development of new technologies for processing and preparing the rock mass involves the use of the properties of rocks inherent in nature to reduce energy consumption for their destruction, to increase the disclosure of ores and the recoverability of minerals. Therefore, it is relevant to study the natural separateness of various rocks in the basalt massif, which can significantly change the approaches and principles of technological impact on them for the subsequent destruction and extraction of [2] minerals. According to many researchers, the destruction of the rock mass separately occurs most pronounced in centrifugal crushers and mills [3]. For example, centrifugal crushers are used to produce crushed stone of a cubic shape at relatively low energy costs. The destruction of the ore body rock containing metal nuggets occurs without grinding metal inclusions. The destruction in this case, obviously, occurs along the so-called reticular planes, characterized by the number of nodes (atoms, ions) of the planar lattice per unit of its plane (in accordance with the Bravais hypothesis). Obvi-

ously, this rule applies not only to crystals, but also to rocks in general.

Based on the positions of blocking and fracturing, the study of basalt exposures under the conditions of the Rafalovsky and Berestovets quarries showed their high fracture (bottom height 15–20 m), pronounced individuality limited by vertical and horizontal cracks. At present, basalt is mined for crushed stone. The technological scheme of production includes overburden operations (the thickness of the sand-chalk layer of the overburden is 2-5 m), drilling of wells in accordance with the passport of drilling and blasting operations, blasting the face, followed by excavator loading in automobile vehicles for delivery to the crushing and screening site. Commercial products in the form of crushed stone in three classes of fineness (-10; 10-20; 20-40 mm) are obtained using gear, cone, centrifugal crushers and vibrating screens.

The economic substantiation of the basalt cotton wool production project in this study was conducted in conventional units in order to show its effectiveness and to reflect the traditional for Ukraine ratio of different types of costs on the example of one of the mining enterprises of Ukraine, located in Rivne region - PJSC "Rafalivsky Quarry".

Trends in modern construction are a clear testament to the growing focus on thermal insulation and energy conservation. In many countries, in addition to effective insulating materials made of polystyrene, polyurethane foam, glass staple fiber, insulation materials based on mineral wool made of [4] basalt stone have been used for more than 30 years. However, it should be noted that the main problem currently facing many developers is the acute shortage of this material, which is increasing over time.

Basalt fiber insulation materials are delivered to the market by a number of domestic manufacturers (there are 7 of them, total design capacity - up to 1 million cubic meters of conventional cotton wool per year). Thus, the Irpine mill «Progress» was the first in Ukraine (since 1969) to start producing ultra-thin fibers on the basis of basalt rocks. Similar products in Ukraine are produced by Belitsky Plant «Thermal Sound Insulation», Kyiv Industrial Complex «Budindustriya», Chernivtsi Plant of Thermal Insulation Materials «Rotis», Zhytomyr Mineral wool Factory.

The strong position of mineral wool from basalt is based on its excellent properties [5]:

• good insulation ability over a wide temperature range, even at high temperatures (the value of the thermal conductivity coefficient is in the range 0.032-0.038 W / mK);

• fire safety - basalt wool does not burn (it effectively prevents the spread of flames and can be used as fire insulation and fire protection);

• good sound insulation (basalt wool is widely used in floor, wall, interior partitions to reduce noise, the best sound insulation is achieved by applying an additional air gap between the insulation and the outer treatment layer);

• good mechanical and chemical resistance (basalt cotton wool products do not shrink and are not susceptible to temperature deformation; no cracks are formed at the junctions between the slabs and joints between the plates, which could cause heat leakage and become the center of moisture condensation) , (has high resistance to chemicals, neither solvents, alkaline, nor acidic media have any effect on it);

• compressive strength;

• a wide range of products;

• does not absorb water (basalt cotton wool is non-hygroscopic, moisture content under normal operating conditions is less than 0.5% by volume);

• safety and environmental friendliness (basalt wool is safe during installation and operation).

Therefore, the physical, mechanical and chemical properties of the basalts of PJSC "Rafalovsky Quarry" allow it to be used for the organization of new industries and types of products. First of all, it is an organization of stonecutting, which will make it possible to produce BSTV (basalt superfine).

The technological module for manufacturing basalt-fiber thermal insulation materials is shown in Fig. 1.

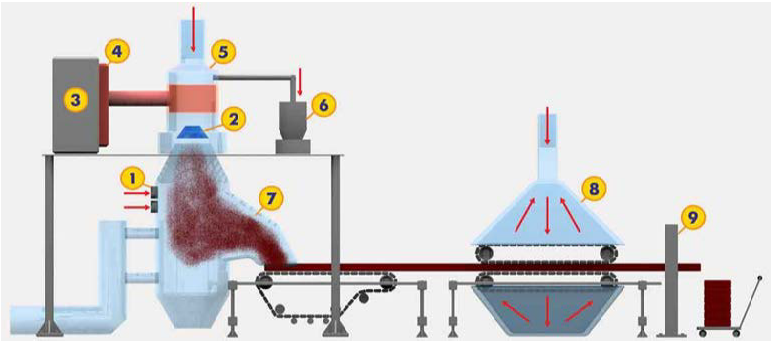

Fig. 1. Technological module for the production of basalt-fiber thermal insulation materials: 1- sprays; 2- blowing head; 3- generator; 4- block of loading circuit; 5- induction furnace; 6-dispenser; 7- fiber-deposition chamber; 8- drying chamber; 9- cutter

The raw material for the production of thermal insulation materials is a basalt crumb with a fraction size of 3-15 mm.

Through the feeder-dispenser crumb enters the melting furnace at t = 1400-1500 ° C is melting.

The temperature in the oven is controlled by the amount of gas supplied and the air.

The air is fed through a metal recuperator, where it is heated by the use of flue gas.

The obtained melt through the feeder filters under the action of its own weight, is extracted in the form of continuous filament, the diameter of which is in the range of 100-250 μm [6].

Production time of the UB STB 42 installation is 1-1.5 months, and installation, commissioning - 0.5-1.0 months.

The composition of the installation and the technical and economic indicators of UW STV 42 are shown in table. 2 and Table. 3 respectively.

Table 2

Composition of the UB STV 42

№	Denomination	Number
1	Oven	4
2	Gas supply system	4
3	Recuperator	4

Continuation of table.2

4	Loader dispenser	4
5	TEC transformer	4
6	Feeder feeders with suspension mechanism	4
7	The hood mechanism	2
8	Inflatable camera	2
9	System of gas-air supply of inflatable cameras	2
10	Diffuser	1
11	Fiber Deposition Camera	1
12	Combustion products cleaning chamber	1
13	Ventilation of removal of combustion products	1
14	Electrical equipment	1
15	Ground	1
16	Water cooling system	1

If necessary, additional sectional ovens can be ordered and installed to increase production capacity. When 2 additional furnaces are installed, the production capacity increases 2.5 times. The BSTV production plant is serviced by one operator per shift.

The mode of operation of the furnace is round-the-clock, the standard of use - 350 days a year. In each shift, except for the operators, there should be: the debugger of the technological equipment, the operator on control and measuring devices and equipment (KVPiA) and the locksmith mechanic.

Accordingly, the need for staff is 15 people (Table 4).

Table 3

Technical and Economic Indicators of UB STV 42 Installation

№	Indicator	Units of measurement	Value
1	Productivity: - hour - production capacity at a coefficient of use of CFRC 0.9	 кg/h t	 30,4 250
2	Gas consumption max per 1 kg BSTV	m^3/кg	3,2
3	Electricity consumption per 1 kg BSTV	kilowatt /кg	2,0
4	Density	кg/m^3	30
5	Installation dimensions: - length - latitude - height	 m	 8,2 5,4 4,4

Table 4

Staffing requirements

№	Position	Number, people	Annual Fund of Remuneration, $
1	Operator	3	54000
2	Debugger	3	43200
3	Mechanic locksmith	3	37800
4	The composer	6	97200
	Total	15	232200

The cost of the equipment is 205 thousand USD, the training of 3 operators and the 1st debugger is 9.6 thousand USD, and the cost of installation, commissioning works is 21.6 thousand USD. It is envisaged to purchase the installation, staff training and preparatory work at their own expense (Table 5). It is envisaged to finance the purchase of additional equipment to provide the shop with compressed air at the expense of a bank loan, using the services of PJSC "State Export-Import Bank of Ukraine".

When forecasting the volume of BSTV output, design capacity is taken into account when the CFRF utilization coefficient is 0.9.

It is planned to receive annually from the production of BSTV 3750 thousand USD. 6).

Table 5

Assignment of investment funds

№	Assignment of investment funds	Sum, thousand USD	Source of funding
1	Purchase of installation	205	Own funds
2	Purchase of equipment to provide the shop with compressed air	105	Credit facilities
3	Training of 3 operators and 1 debugger	9,6	Own funds
4	Installation, commissioning	21,6	Own funds
Total:		341,2	

Data on the total volume of production of BSTV were used to draw up a plan of income and expenses for the implementation of UB STB 42 PJSC "Rafalovsky Quarry" for the relevant years of its operation. Based on the technical and economic characteristics of the UB STV 42 installation, we will calculate the cost of natural gas and elec-

tricity. It is known that natural gas consumption is 3.2 m^3/kg and electricity is 2 kW/kg.

Natural gas consumption per year is:

250,000 kg 3.2 m^3 = 800 thousand m^3

The price of gas per 1000 m^3 for industrial enterprises as of May 1, 2010 is 2637,78 USD (without VAT).

The annual cost of natural gas is:

800 2637.78 = 2110224 $.

Electricity consumption per year is:

250,000 kg 2 kW = 500 thousand kW

500 000 0.65 = 325 000 UAH

Based on the above data, we calculate performance indicators for the implementation of the installation [7] (Table 7).

The calculated data shows that the project is acceptable. Because the yield index is larger than one unit and the payback period is 7.8 months.

Determination of break-even point of sales and financial strength are given in Table 8.

Table 6

Plan of income and expenses of the implementation of the UHF STB 42 installation of PJSC "Rafaliv Quarry" in thousand USD

№	Indicator	Year				Total
		base	first	second	third	
		0	1	2	3	
1	Revenue from the sale of products	-	3750	3750	3750	11250
2	Costs of everything, including	-	2854,5	2854,5	2854,5	8563,49
3	material costs	-	2435,22	2435,22	2435,22	7305,67
4	wages of workers	-	232,2	232,2	232,2	696,6
5	payroll	-	87,1	87,1	87,1	261,3
6	Selling expenses	-	100	100	100	300
7	Profit from sales of products	-	895,5	895,5	895,5	2686,5
8	Total investment, including: -own funds -credit resources	341,2 236,2 105	0	0	0	341,2 236,2 105
9	Annual credit payment	-	35	35	35	105
10	Interest on the loan	-	22,05	14,7	7,35	44,1
11	Credit balance at year-end	-	70	35	0	105
12	Loan Amounts Paid	-	57,05	49,7	42,35	149,1
13	Profit before tax	-	838,451	845,801	853,15	2537,40
14	Income tax (25%)	-	209,61	211,45	213,29	634,35

Continuation of table.6

15	Net profit	-	628,84	634,35	639,86	1903,05
16	Amount of depreciation	230	15,33	15,33	15,33	45,99
17	The total income of the enterprise	-	644,17	649,68	655,20	1949,05

Table 7

Calculation of economic efficiency indicators for the implementation of the UWB STB 42

№	Indicator	Year				Total
		base	first	second	third	
		0	1	2	3	
1	Capital investments, thousand USD	341,2	-	-	-	341,2
2	The total income of the enterprise, thousand USD	-	644,17	649,68	655,20	1949,05
3	The discount rate (20%)	1	0,83	0,69	0,58	-
4	Discounted income thousand USD	0	524,03	440,52	370,29	1334,84
5	Yield Index	1334.84 341,2				3,9
6	Payback period, months	341,2 524,03				7,8

Table 8

Calculation of break-even volume of production and stock of financial strength

№	Indicator	Units measurement	Forecast year
1	Production volume	m^3	8333,3
2	Price	dollars	450
3	Sales revenue (excluding VAT)	thousands of dollars	3750
4	Total variable costs	thousands of dollars	2435,22
5	Variable cost per 1 m^3	dollars	292,23
6	Fixed costs	thousands of dollars	434,6
7	Break-even production volume	thousands of dollars	1239,57
8	Stock of Financial Sustainability (SFS)	thousands of dollars	2510,43
9	Stock of financial stability	%	67

According to the calculation method, the break-even point will be calculated as

$$T_b^{natur} = \frac{UPV_t}{P_0 - UZV_0}$$

$$T_b^v = T_b^{natur} \cdot P_0.$$

$$T_b^{natur} = \frac{434600}{450 - \frac{2435220}{8333,3}} = 2754,6 \quad m^3$$

$$T_b^v = 2754,6 \cdot 450 = 1239570 \quad dollars.$$

Therefore, the estimated break-even point of the rendered services of PJSC «Rafalovsky Quarry» is. This means that the break-even points of PJSC «Rafalovsky Quarry» can reach the first four months of the plant's operation.

We present a graphically defined break-even point and a margin of financial strength (Fig. 2).

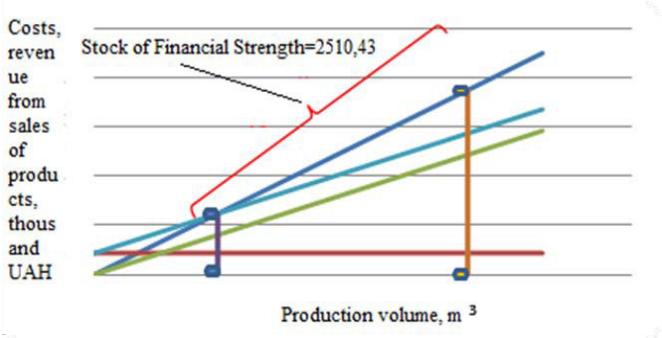

Fig. 2. Determination of critical sales volume of basalt superfine and financial strength

As the above chart shows, in order to cover all costs, the company must sell products worth 1239.57 thousand USD. (TB). According to estimates, sales revenue will exceed TB by 67% ($ 2510.43 thousand), which will mean a fairly stable financial position in the future.

In the current fierce competition and increasing influence of changes occurring in the external environment, the company should focus not only on the internal state of affairs, but also take into ac-

count and identify in their activities possible changes in the environment [8].

Reliable, complete information about the state of the external environment of the enterprise is considered, evaluated and analyzed in such a functional element as marketing. Marketing as a process involves the analysis of market opportunities; selection of target markets; development of marketing complex and implementation of marketing activities.

Studying the possible behavior of the closest competitors is indispensable. If the company does not pay attention to its competitors, it enters the competition blindly. Analyzing the organizational structure of PJSC «Rafalovsky Quarry», it should be noted that the enterprise does not have a marketing department and people who would be engaged in marketing research and development of the marketing complex of price, commodity, marketing and communication policies. Therefore, the lack of a marketing service makes the enterprise unstable and vulnerable to changes in the external environment.

Considering the fact that in the production of new types of products the enterprise should focus on the promotion of goods to the market, namely: to determine the best way to achieve a strategic goal for each division of the enterprise, to formulate an effective commodity, price, marketing and communication policy. Therefore, the creation of a marketing service at PJSC «Rafalovsky Quarry» is an extremely urgent task and an important component of the enterprise structure to ensure the successful operation of the enterprise in the future.

Marketing managers don't always aim to drive sales. Their goal may be to support existing sales while reducing costs for advertising and promoting products, or even reducing demand. In other words, the marketing service must support demand at the level set in the senior management's strategic plans. Marketing helps the company evaluate the potential of each business unit of the company, set goals for each of them and then successfully achieve them.

Therefore, it is advisable to investigate the dependence of sales revenue on sales costs as components of marketing costs, where x is sales costs and y is sales revenue. To investigate separately the impact of this category on sales revenue, you need to examine the rela-

tionship between them based on metrics. Namely: the correlation coefficient, the parameters of the regression equation.

Using Excel, we derive the relationship of the relationship between the studied indicators, as well as the correlation coefficient and parameters of the regression equation.

The regression equation looks like:

$$y=20.66x - 1029$$

Therefore, the relationship between sales costs and sales revenue is close and straightforward, which means that by increasing costs by $ 1, sales revenue will increase by $ 20.66.

Therefore, it is advisable for the company to spend on marketing. Calculate the coefficient of elasticity

$$E = a_1 \frac{\overline{x}}{\overline{y}} = 20,66 \frac{535,66}{10037,62} = 1,1$$

According to the calculated coefficient of elasticity, the revenue will increase by 10% while the increase in sales costs by 1%.

The cost of organizing the marketing department at PJSC «Rafalovsky Quarry» will be $ 140,000 per year.

Advertising costs will be $ 12800, which includes the creation of your own website on the Internet, advertising in periodicals and more.

It is planned to introduce a position of marketer in the field of innovation. The main task of which is the search, research, analysis and implementation of new products at the enterprise, as well as benchmarking. Benchmarking is a comparison of your metrics and processes with those of other companies, most notably market leaders. The focus of benchmarking is the question: Why are others doing better than we are? The main purpose and purpose of benchmarking is to identify differences with a comparable analogue (benchmark), identify the causes of these differences, and identify opportunities to improve the objects of benchmarking. Objects of benchmarking can be: methods, processes, technologies, quality parameters of production, indicators of financial and economic activity of enterprises (structural units). When researching production processes, methods or technologies of production and marketing, the focus is on finding reserves to reduce production costs and increase product competitiveness through the introduction of [9] innovation.

It should be noted that the study of the innovative component of the macro environment allows the company not to miss the "technological leap" and maintain its competitiveness at the appropriate level. Therefore, the efficiency of the enterprise depends on the innovation factors.

Thus, the analysis of innovations, the study of "external innovations" allows to notice in a timely manner the opportunities which science and technology opens for production of products, improvement and modification of technology of production and marketing of products [8]. This category includes expenditures on science and technology (state, investors), patent-license protection of technologies, innovative processes in the field of enterprise functioning. PJSC «Rafalovsky Quarry» is difficult to keep track of new directions of technology development, since their development is beyond its scope of activity, so there is a real threat of delayed implementation and, consequently, loss of market share. There is the task of constantly monitoring changes in the design of new technologies, which will be fixed precisely by the marketer in the innovation sphere. One important approach to addressing this is technology transfer. It is that laboratory developments are brought to the market where they can be purchased.

In the end, the use of modern technology and technology will enable the company to reduce its costs per unit of output, produce better quality and upgraded products, directly increase production, which will allow the company to generate more revenue.

Due to the organization of the marketing service, it is planned to increase the production and sales of stone-crushed stone products in the next year, and thus to generate 10% more revenue than in the previous year, according to the calculated coefficient of elasticity, as well as to obtain a net profit of 788.4 thousand USD in the next reporting period (Table 9).

Table 9

Comparative characteristics of indicators before and after organization of marketing department at PJSC «Rafalovsky Quarry»

№	Indicators, thousand USD	To	After
		organization of marketing service	
1	Volume of sales	12312	13543,2
2	Production costs	12352	12492
3	Balance sheet profit	(40)	1051,2
4	Income tax	-	262,8
5	Net profit	-	788,4

The company must have people capable of conducting market analysis, planning marketing activities, their implementation and control. The practical use of theoretical material and the creation and implementation of a marketing service at the enterprise will have a positive effect, increase the level of profit and will help to expand its market share.

Therefore, it is recommended to improve the organizational structure and attract qualified marketing specialists (including benchmarking) to form a market research unit.

Conclusions

The implementation of the UB STV 42 installation will provide production of BSTV for the amount of 3750 thousand USD. Labor productivity will grow from 112.55 thousand USD/person up to 122,61 thousand USD/person (108.9%). Net adjusted income for 3 years will be 1334,84 thousand USD.

Introduction of marketing service will increase the sales volume of products by 10% in the next reporting period, which will amount to 13543,2 thousand USD. The total expenses of the enterprise will increase by 140 thousand USD, correspondingly the net profit will be 788,4 thousand USD. The profitability of sales will increase in the next period and will make 5,8%.

Therefore, thanks to the introduction of innovations and their marketing support, the company will expand its product range and become more flexible to changes in the environment.

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