

МАТЕМАТИЧНІ МЕТОДИ, МОДЕЛІ Й ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ В ЕКОНОМІЦІ

UDC 519.85

ENTERPRISE PRODUCTION PROGRAM ECONOMIC-MATHEMATICAL MODELING

**Yu. Kharchenko, PhD (Technical Sciences), Associate Professor,
Poltava National Technical Yurii Kondratiuk University**

© Kharchenko Yu., 2017.

Стаття отримана редакцією 17.10.2017 р.

Introduction. Market principles usage in the goods assortment formation connects with implementation systematic approach to enterprises with defined goals and objectives. In order to compile the optimal list of goods, it is necessary systematically to collect and analyze data on the consumers' needs structure, challenging production, financial and personnel enterprise needs. The most important meaning is in information that provides valid answers to questions about how to produce and how to achieve the required efficiency. If earlier only prices were compared, but now the main focus is on quality, market novelty, advertising, after-sales service level etc. Therefore, the advantage on the market has the one who can offer the most competitive product with a certain set of services.

Production program or plan for production and sales is an important part of the enterprise current plan. It determines the necessary production overall during the planned period, which corresponds for the range, assortment and quality requirements to the sales targets. It also stipulates the task of implementing into operation new production facilities, the need for equipment and raw material resources, the number of personnel, transport, etc. Therefore, in order to ensure the enterprise competitiveness and effective activity it is necessary constantly to improve the production program formation model.

Recent researches and publications analysis. Industrial enterprises tasks of industrial activity planning economic-mathematical models are studied and described in many research papers. So the paper [1] presents the concept and algorithm of the complex production program development and implementation. Efficiency estimates of the product range management system on the bakery market are presented in paper [2]. Financial results and practical recommendations for enterprise efficiency improving are investigated and provided in the paper [3]. Production program optimization as a part of the dynamic system of the enterprise activity planning was carried out in research paper [4]. The process of forming an enterprise's production program is considered and mathematical model for estimating the level of environmental uncertainty is proposed in the publication [5].

Enterprise production program planning system using economic and mathematical methods and models is proposed in research paper [6]. The article [7] substantiates the necessity and expediency of the production program fuzzy linear optimization model with flexible restrictions of production resources. Complex analysis was carried out and some methods of forming an effective goods assortment were proposed in the paper [8]. Kigel V.R. in paper [9] developed production program formation models based on the analysis system; mathematical modeling and optimization of business entities using mathematical methods for making economic decisions in a market economy. Basic modeling principles and applications examples for solving management problems in the Microsoft Excel environment are described in the book [10].

Despite a large number of scientific publications on the chosen topic enterprise's production program formation economic-mathematical model needs further improvement.

Problem statement. The paper purpose is economic-mathematical model development and implementation for optimization the enterprise's production program goods assortment formation.

Basic materials and results. The bread baking industry is one of the leading branches of the food industry in Ukraine. It is intended for continued bread production, bakery and other flour products in the amount that corresponds to the food supply security norms. Due to the products short term storage bread market has a local character.

Bread and bakery products traditionally occupy a special place in the domestic consumption structure, as these products in Ukraine account for up to 40% of the total caloric content of the population food ration. As a matter of fact, therefore, the production of bread and bakery products can be attributed to the economy strategic sectors in our country, as not only food but also national security of the country depends on the baking enterprises activity efficiency.

The bread baking market is developing, goods assortment is expanding, new tasks arise, therefore, it requires constant research. During recent years overall production have been decreasing, what is related to the consumption reduction, the demographic situation in the country and overall bread baking increase in small bakeries, unprofitable enterprises closure. 2010-2016 statistical data analysis display a tendency to decrease the bread and bakery products overall production bigger by half.

The modern structure of the Ukrainian bakery market is 75% represented by medium and large industrial enterprises, and 25% is formed by consumer co-operation enterprises and petty private sector.

Poltava region bread market analysis has shown a tendency to decrease the production overall during recent years, while the food industry has a tendency to increase. Bakery products production per capita has significantly decreased. Consumers' desire to a healthy lifestyle gives preference to producers of bakery products with useful additive. Despite the fact that, according to statistical information, bread and bakery products market is reduced in actual measurements, it continues to grow due to the demand for more expensive and quality products. Bread baking enterprises are forced constantly to expand the range and modernize production facilities for effectual operating on the market.

Kotelevskiy district consumer cooperation bread baking enterprises produce a wide range of sourdough bakery and confectionery products according to State Standards of Ukraine (GOST, DSTU) and national and own recipes. One of the main bakery producers in the area is the Bakery "Korovai" of Kotelevskiy District Consumer Society.

Sales revenue constant growth rates for the amount of expended money affect not only the overall sales, but also the prices for the purchase of raw materials and finished products sales, as well as the term for the calculation of raw materials and time of payment for finished products. If the prices for raw materials, energy and materials grow faster than the prices for finished products, the production profitability falls.

Optimal product range formation needs to be done taking into account the prospects of enterprise development. The developed model should reflect, on the one hand, the needs of consumers of a certain segment of the market, and on the other hand, provide the most effective enterprise raw materials, technological, financial and labor resources usage. The main task of the enterprise's production program is to maximize the satisfaction of consumers' needs for quality products, with the optimal use of its resources and maximizing profits. In order to solve a task while developing a production program, the following requirements should be taken into account:

- 1) the correct definition of the production overall, according to the consumers demand;
- 2) natural and cost indicators of production overall and sales of products full harmonization;
- 3) plan distinct substantiation for the resource production and first of all the production capacity.

One of the ways to ensure the efficient operation of the bakery enterprises is to use modern information technology and economic-mathematical models to substantiate management decisions, in particular, regarding the formation of an enterprise's production program. Individual products production overall is substantiate by the production capacity. At the level of the industrial enterprise, specification is ensured by the demand of consumers and available economic contracts according to the products stock list. During the program development, there are internal production disproportions in the equipment loading, the ways of their elimination are determined, as well as measures to expand the specialization and production cooperation.

Production program planning is carried out in accordance with natural and cost indicators production overall system. The natural indicators are the production overall in physical units (pieces, tons) in the stock list and assortment (types of products within the given stock list). The significance of these indicators in the market environment is increasing as they provide an opportunity to assess consumers' satisfaction degree of needs in certain products, taking into account their qualitative characteristics.

One of the most important stages in the production program development is the definition of resource requirements, which is calculated on the basis of the direct calculation method according to the specific norms of their production cost. Production program optimization is carried out in order to:

- 1) products stock list rational structure planning;
- 2) maximum possible production overall and stepping-up production economic limit determination.

Optimal production program must match the enterprise resources structure and ensure the best result of its activities according to the accepted criteria. The formulated optimization problem is solved by economic-mathematical modeling methods.

The whole range of works aimed at stock list products optimization is carried out according to the following algorithm:

- studying the optimization object, in particular, the structure of the various features range (type, purpose, consumers' gender and age, price, etc.);
- internal (industrial) and external (demand) production limitations analysis;
- assortment formation model development and substantiation.

Target function can be revenue, profit, sales, etc. During the assortment formation the following restrictions may be established:

- ratio of labour to output;
- material, energy and labour resources;
- products demand;
- competitiveness level of products;
- products life cycle etc.

The main tasks during the research the products stock list and assortment are the following:

- optimization of the stock list and assortment taking into account consumer characteristics and production technology features;
- renewal of the products in a whole and by individual types taking into account the products life cycle;
- the optimal ratio of new and "old" products in the program;
- optimal ratio of new and existing markets;
- product renewal level; in other words products output with market novelty;
- products phase out that have lost market positions.

An important part of the enterprise current plan is a production program or production plan and products marketing. The production program determines the required production overall during the planned period, which corresponds to the range, assortment and quality requirements of the sales plan. Bakery «Korovai» assortment products includes 37 bakery products range. The demand structure for bakery products among consumers is presented in Fig. 1.

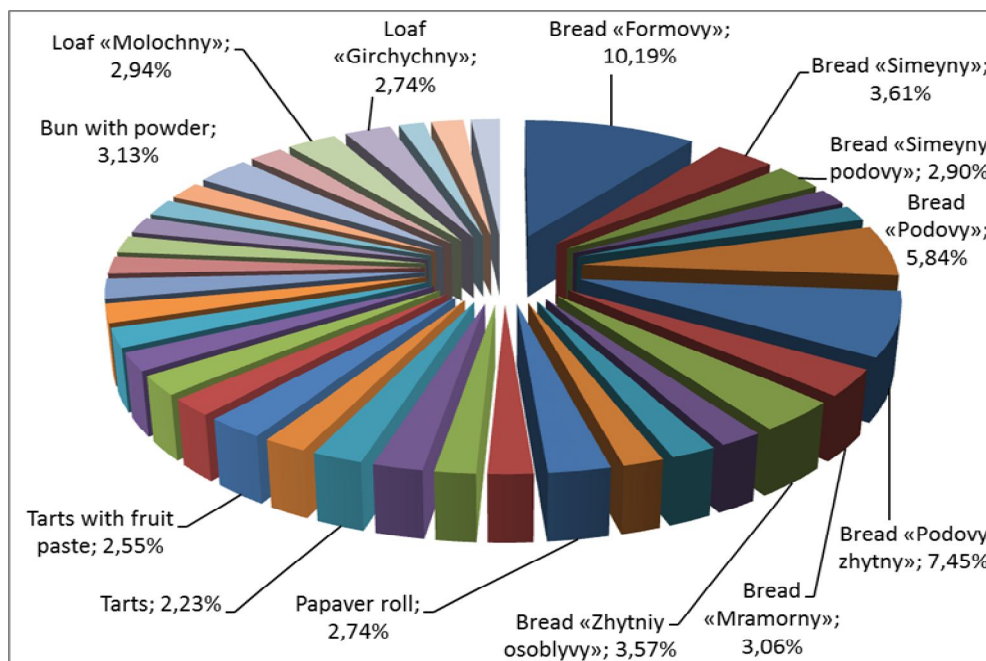


Figure 1. Demand structure for «Korovai» bakery products

According to the data analysis results, it is determined that bread «Formovyi», «Podovyi Zhytnii» and «Podovyi» are in great demand among consumers, which sales exceed 5%. In order to determine the optimal range of bakery products that will provide the bakery at the same cost with maximum revenue, enterprise production program optimization model is used [9].

To ensure the continued production process the company maintains a certain amount of resource stocks. Also it is known consumption norms of each type of raw material per unit of each product, the minimum and maximum amount of production resource batch that can be purchased, the cost of purchasing additional productive resources. Delivery of raw materials, according to the contract, takes place once a week. According to statistical data, the average demand for products per week is calculated. Consequently, it is necessary to develop an optimal production program for the bread baking production in order to obtain the maximum income from the sale of all manufactured products.

The need to purchase additional raw materials is determined by the ratio of prices for productive resources and manufactured products. The quantity of manufactured products depends on the existing demand and for popular types of bread there is a limit for the minimum quantity.

Deterministic economic mathematical model problem of determining enterprise optimal production program is the following:

$$\left. \begin{aligned} z &= \sum_{j=1}^n p_j \cdot x_j - \sum_{i=1}^m v_i \cdot q_i \rightarrow \max \\ \sum_{j=1}^n a_{ij} x_j - y_i &= 0, i = 1, \dots, m \\ y_i - v_i &= b_i, i = 1, \dots, m \\ x_j^{\min} \leq x_j \leq x_j^{\max}, j &= 1, \dots, n, y_i^{\min} \leq y_i \leq y_i^{\max}, i = 1, \dots, m \\ v_i^{\min} \leq v_i \leq v_i^{\max}, i &= 1, \dots, m \end{aligned} \right\}. \quad (1)$$

This model known quantity is: n – products items quantity (goods or service), which can be produced by the enterprise; j – certain products item number (j = 1, ..., n); m – operating resources types quantity; i – certain operating resource type number (i = 1, ..., m); a_{ij} – i-operating resource standard expense allowance for j-type goods production; b_i – actual operating resources i-type overall; x_j^{\max}, x_j^{\min} – appropriate upper and lower production overall limits of j-type products; y_i^{\max}, y_i^{\min} – appropriate upper and lower production usage limits of i-types resource; v_i^{\max}, v_i^{\min} – appropriate upper and lower limits of purchasing additional i-type operating resources overall.

Unknown quantity (controlled parameter) is: x_j – production overall and j-type; y_i – i-resource productive consumption overall; v_i – i-type productive resources purchasing overall; z – total enterprise income. Model uncontrolled parameters: p_j (j - type production unit market price) and q_i (i-type operating resource unit market price) in deterministic model are constants during certain period.

Target function is the maximum enterprise total income, which is calculated as the difference between the value of sold products and the cost of purchased additional raw materials.

Controlled parameters points are determined by the following restrictions:

- raw material costs do not exceed total stocks;
- the purchase indicator is a binary number;
- the quantity of purchase is not less than the minimum purchase batch and does not exceed the maximum batch of raw materials transportation;
- the quantity of manufactured products is an integral number;
- the production plan should not exceed the average demand for the goods in a week;
- the quantity of manufactured products is an integer;
- production taking into account the existing demand for bread: «Formovyi» ≥ 200, «Podovyi zhytnii» ≥ 100, «Podovyi» ≥ 80, «Simeinyi» ≥ 50 pieces.

Economic mathematical model is performed using the application MS Excel «Poisk resheniya». The results are shown in Fig. 2 – 4.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Production	Raw material, kg											Price for 1kg, UAH	
2		Flour	Yeast	Fat	Salt	Vegetables	Garlic	Fruit paste	Papaver	Sugar	Berries	Cheese		Raisins
3	Baguette	0,69	0,025	0,05	0,03	0	0	0	0	0	0	0	0	14,25
4	Loaf" Girchychny"	0,70	0,020	0,05	0,03	0	0	0	0	0	0	0	0	14,89
5	Loaf" Molochny"	0,60	0,050	0,12	0,03	0	0	0	0	0	0	0	0	16,00
6	Soft ring- shaped roll	0,68	0,010	0,03	0,05	0	0	0	0	0,15	0	0	0	30,00
7	Bun with powder	0,50	0,020	0,07	0	0	0	0	0	0,15	0	0	0,10	32,00
8	Fruit paste filled pastry	0,45	0,030	0,06	0	0	0	0,25	0	0,10	0	0	0	45,45
9	Chese filled pastry	0,45	0,030	0,06	0	0	0	0	0	0,10	0	0,25	0	35,00
10	Wreath with papaver	0,55	0,005	0,02	0	0	0	0	0,20	0,10	0	0	0	20,57
11	Pocket-shaped bun (Kotelevskyi)	0,60	0,010	0,02	0,03	0	0	0	0,05	0,10	0	0	0,05	17,75
12	Cupcake "Stolichny"	0,68	0,030	0,05	0	0	0	0	0	0,05	0	0	0,05	26,67
13	Round loaf	0,75	0,020	0,03	0,03	0	0	0	0	0,10	0	0	0	55,00
14	Round loaf with fruit paste	0,50	0,100	0,02	0,03	0	0	0,15	0,05	0,10	0	0	0	75,00
15	Pita	0,75	0,02	0,02	0,03	0	0	0	0	0	0	0	0	14,00
16	Garlic donut (Pampushka)	0,60	0,01	0,02	0,03	0	0,15	0	0	0	0	0	0	15,50
17	Cabbage, potatoe pies	0,50	0,02	0,04	0,04	0,25	0	0	0	0	0	0	0	44,44
18	Papaver pies	0,50	0,02	0,04	0	0	0	0	0,25	0,15	0	0	0	47,78
19	Fruit paste pies	0,50	0,02	0,04	0	0	0	0,25	0	0,15	0	0	0	42,22
20	Chese pies	0,50	0,02	0,04	0	0	0	0	0	0,2	0	0,2	0	47,78
21	Berries pies	0,50	0,02	0,04	0	0	0	0	0	0,15	0,25	0	0	43,00
22	Bun "Zaychik"	0,50	0,005	0,04	0	0	0	0	0	0,11	0	0	0,15	35,00
23	Donut	0,55	0,03	0,06	0,05	0	0	0	0	0,15	0	0	0	44,44
24	Croissant with fruit paste	0,50	0,005	0,01	0	0	0	0,15	0	0,15	0	0	0	20,45
25	Papaver roll	0,55	0,015	0,03	0	0	0	0	0,20	0,10	0	0	0	20,00
26	Simeyka wih raisins	0,45	0,015	0,03	0	0	0	0	0	0,15	0	0	0,20	25,50
27	Simeyka wih papaver	0,45	0,015	0,03	0	0	0	0	0,20	0,15	0	0	0	25,30
28	Georgian chese- pie	0,52	0,02	0,04	0	0	0	0	0	0,10	0	0,25	0	53,85
29	Bread "Zhytniy osoblyv"	0,70	0,02	0,05	0,10	0	0	0	0	0	0	0	0	12,12

Figure 2. Simulation results in Microsoft Excel

The enterprise provides raw materials purchases once a week. Suppliers of raw materials to the enterprise can be divided into three groups. The first one is the bakery buys flour from not more than 1 ton per week.

30	Bread "Mramorny"	0,60	0,05	0,10	0,05	0	0	0	0	0,10	0	0	0	35,00
31	Bread "Podovy zhytny"	0,76	0,02	0,04	0,03	0	0	0	0	0	0	0	0	11,27
32	Bread "Podovy"	0,76	0,01	0,02	0,03	0	0	0	0	0	0	0	0	11,27
33	Bread "Svyatkovy"	0,55	0,04	0,1	0,05	0	0	0	0	0,10	0	0	0,10	55,00
34	Bread "Borodinskiy"	0,73	0,02	0,03	0,03	0	0	0	0	0	0	0	0	14,00
35	Bread "Simeyny podovy"	0,65	0,05	0,10	0,03	0	0	0	0	0	0	0	0	13,33
36	Bread "Simeyny"	0,69	0,005	0,02	0,08	0	0	0	0	0	0	0	0	10,34
37	Bread "Formovy"	0,70	0,025	0,05	0,03	0	0	0	0	0	0	0	0	12,00
38	Sweet bun	0,65	0,01	0,02	0,05	0	0	0	0	0,10	0	0	0,10	50,00
39	School roll	0,55	0,005	0,01	0	0	0	0	0	0,10	0	0	0,15	35,00
40	Raw material stocks, kg	0	150	200	20	20	20	20	20	25	25	25	25	
41	Raw material consumption, kg	999,97	37,55	82,4	38,71	18,00	3,45	42,35	20,00	125	14,25	36,25	41,45	
42	min batch, kg	1000	30	30	30	20	20	20	20	20	20	20	20	
43	min batch (taking into account indicator), kg	1000	0	0	30	0	0	20	0	20	0	20	20	
44	Purchase price, UAH	6,00	22,32	26,2	3,50	4,50	45,00	48,80	42,00	12,20	40	26,50	45,00	
45	Purchase indicator	1	0	0	1	0	0	1	0	1	0	1	1	
46	Purchasing(quantity), kg	1000	0	0	30	0	0	22	0	110	0	20	20	Sum
47	Purchase cost, UAH	6000,00	0,00	0,00	105,00	0,00	0,00	1072,62	0,00	1342,00	0,00	530,00	900,00	9949,62
48	Total stock, kg	1000	150	200	50	20	20	42	20	135	25	45	45	
49	Surplus for next week, kg	0	112	118	11	2	17	0	0	10	11	9	4	
50														
51	Raw material limitation 1	1000	1000											
52	Raw material limitation 2	30	150											
53	Raw material limitation 3	172	200											
54	Production limitation	1691	1900											

	A	O	P	Q	R	S	T	U	V
1	Production	Average demand for products per week, kg	Current output, kg	Production Plan, kg	Cost, UAH	Prime cost, UAH	Total Expenses, UAH	Income, UAH	Profitability, %
2									
3	Baguette	62,0	37,0	0,0	0,00	6,11	0,00	0,00	
4	Loaf "Girychyny"	70,0	66,0	0,0	0,00	6,06	0,00	0,00	
5	Loaf "Molochny"	75,0	67,0	75,0	1200,00	7,96	597,00	603,00	101,01%
6	Soft ring- shaped roll	58,0	37,0	58,0	1740,00	7,09	411,22	1328,78	323,13%
7	Bun with powder	80,0	37,0	80,0	2560,00	11,61	928,80	1631,20	175,62%
8	Fruit paste filled pastry	45,0	27,0	45,0	2045,25	18,16	817,20	1228,05	150,28%
9	Cheese filled pastry	49,0	27,0	49,0	1715,00	12,78	626,22	1088,78	173,87%
10	Wreath with papaver	55,0	41,0	0,0	0,00	13,55	0,00	0,00	
11	Pocket-shaped bun (Kotelevskyi)	47,0	30,0	13,0	230,75	10,02	130,26	100,49	77,15%
12	Cupcake "Stolichny"	63,0	35,0	63,0	1680,21	8,92	561,96	1118,25	198,99%
13	Round loaf	50,0	27,0	50,0	2750,00	7,58	379,00	2371,00	625,59%
14	Round loaf with fruit paste	55,0	26,0	55,0	4125,00	14,37	790,35	3334,65	421,92%
15	Pita	45,0	30,0	0,0	0,00	5,57	0,00	0,00	
16	Garlic donut (Pampushka)	23,0	17,0	23,0	356,50	11,20	257,60	98,90	38,39%
17	Cabbage, potatoe pies	72,0	36,0	72,0	3199,68	5,76	414,72	2784,96	671,53%
18	Papaver pies	60,0	36,0	60,0	2866,80	16,82	1009,20	1857,60	184,07%
19	Fruit paste pies	65,0	36,0	65,0	2744,66	18,32	1190,80	1553,86	130,49%
20	Cheese pies	55,0	37,0	55,0	2627,90	12,23	672,65	1955,25	290,68%
21	Berries pies	57,0	36,0	57,0	2451,00	16,32	930,69	1520,31	163,35%
22	Bun "Zaychik"	40,0	27,0	40,0	1400,00	12,12	484,80	915,20	188,78%
23	Donut	44,0	27,0	44,0	1955,36	7,54	331,76	1623,60	489,39%
24	Croissant with fruit paste	48,0	27,0	44,0	899,80	12,40	545,60	354,20	64,92%
25	Papaver roll	70,0	35,0	0,0	0,00	14,04	0,00	0,00	
26	Simeyka wih raisins	47,0	27,0	47,0	1198,50	14,65	688,55	509,95	74,06%
27	Simeyka wih papaver	39,0	25,0	8,0	202,40	14,05	112,40	90,00	80,07%
28	Georgian chese- pie	52,0	35,0	52,0	2800,20	12,46	647,92	2152,28	332,18%
29	Bread "Zhytniy osoblyv"	91,0	56,0	0,0	0,00	6,30	0,00	0,00	

Figure 3. Simulation results in Microsoft Excel

	A	O	P	Q	R	S	T	U	V
30	Bread "Mramorny"	78,0	56,0	78,0	2730,00	8,73	680,94	2049,06	300,92%
31	Bread "Podovy zhytny"	190,0	145,0	100,0	1127,00	6,16	616,00	511,00	82,95%
32	Bread "Podovy"	149,0	127,0	80,0	901,60	5,41	432,80	468,80	108,32%
33	Bread "Svyatkovy"	71,0	46,0	71,0	3905,00	12,70	901,70	3003,30	333,07%
34	Bread "Borodinskiy"	64,0	46,0	0,0	0,00	5,72	0,00	0,00	
35	Bread "Simeyny podovy"	74,0	45,0	0,0	0,00	7,74	0,00	0,00	
36	Bread "Simeyny"	92,0	67,0	50,0	517,00	5,05	252,50	264,50	104,75%
37	Bread "Formovy"	260,0	247,0	200,0	2400,00	6,17	1234,00	1166,00	94,49%
38	Sweet bun	28,0	16,0	28,0	1400,00	10,54	295,12	1104,88	374,38%
39	School roll	29,0	17,0	29,0	1015,00	11,64	337,56	677,44	200,69%
40	Raw material stocks, kg	2552,0	1756,0	1691,0	54744,61		17279,32	37465,29	
41	Raw material consumption, kg								
42	min batch, kg								44794,99

Figure 4. Simulation results in Microsoft Excel

The second group supplies yeast, fats (oil, margarine), salt, vegetables, garlic not more than 150 kg per week. Third are the suppliers of fruit paste, poppy seeds, sugar, fruit, cheese, raisins in an amount not greater than 200 kg per week. According to the received modeling data, the company must purchase the maximum amount of raw materials under the contract with the supplier of flour, in the second group of suppliers, respectively, 30 kg, and the third group – 172 kg of raw materials. Taking into account stocks of raw materials that were at the enterprise in the current period, the optimal production plan for the bakery products manufacturing was calculated. So, it is necessary to buy raw materials in the following quantities: flour 1 ton, salt 30 kg, fruit paste 23 kg, sugar 110 kg, cheese 20 kg, raisins 20 kg.

The total enterprise production per week is equal to 1756 kg of product according to the information received by the bakery producing 1691 kg per week (bakery production capacity – 1900 kg) makes economic

sense. After implementation of the developed production program, the enterprise will receive profit taking into account the existing stocks in the amount of 44794,99 UAH, which is 6% higher than the current level.

While analyzing the production assortment, products that were not expedient to produce (baguette, loaf «Hirchychnyi», wreath with poppy, pita bread, poppy roll, and bread «Zhytnii osoblyvnyi», «Borodinskyi» and «Simeinyi Podovyi») were determined. These products should be either eliminated from production or its baking formula should be improved. Thus, a certain reduction in production will increase the profit of the bakery by optimizing the product range.

Conclusions. The result of the study is the development and implementation of an economic-mathematical model for optimizing the range of products. It allows managing the process of formation expenses and income redistribution through the range in favor of more profitable products on the basis of consumer demand. The analysis made possible to identify specific products share of total sales and distribute them according to the level of profitability. Products stock list management from the balance standpoint provides quality managing decision regarding the development strategy while creating production program. It also minimizes risks, provides a balanced growth of the company, and identifies priority business areas. It will increase the bakery competitiveness and profit. The developed model can be used in modern economic conditions during the formation of production programs of bakery enterprises.

REFERENCES:

1. Chorna L.O. Production program. Problems of organization / L.O. Chorna, O.M. Chumak, N.Yu. Chorna // Effective economy: electronic scientific professional edition. – 2010. – №10. [Electronic resource]. – Access mode: <http://www.economy.nayka.com.ua/?op=1&z=375>
2. Bilenkyi O.Yu. Improvement of the product assortment management system: directions and effectiveness / O.Yu. Bilenkyi // Bulletin of the ONU named after I.I. Mechnikov. – 2013. – Volume 18. – № 1/1. – P. 31 – 37.
3. Haidaenko O. Analysis of breakevency of the enterprise by the example of «Dnipropetrovsk bakery №9» / O. Haidaenko, T. Kushnir // ACCOUNTANCY ECONOMY. MANAGEMENT: scientific notes: international collection of scientific works of Lutsk NTU. – 2016. – № 1 (9). – Part 1. – P. 72 – 78.
4. Paderin I.D. Production program as the basis of a dynamic industrial enterprise planning system / I.D. Paderin // Journal of the AMSU. The series «Economics». – 2015. – № 1 (53). – P. 135 – 142.
5. Povidaichyk M.M. Features of strategic planning production program of the light industry enterprise under conditions of uncertainty / M.M. Povidaichyk // Scientific Bulletin of Uzhhorod University. The series «Economics». – 2014. – №. 1 (42). – P. 59 – 63.
6. Feschur R.V. Marketing planning of the enterprise's production program / R.V. Feschur, O.B. Svirska // Theoretical and applied issues of economics: a collection of scientific works of the Kiev National University. – 2010. – №. 23. – P. 112 – 121.
7. Karpenko I.I. Optimization of the enterprise's production program due to unclear restrictions / I.I. Karpenko // Development management of complex systems: a collection of scientific works of the Kiev National University of Construction and Architecture. – 2014. – № 20. – P. 170 – 173.
8. Zerniuk O.V. Analysis of the efficiency of bread assortment range / O.V. Zerniuk, A.P. Hontar // Bulletin of the Khmelnytskyi National University «Economic Sciences». – 2012. – №. 3. – T.1. – P. 186 – 190.
9. Kihel V.R. Mathematical methods of a market economy: a manual / V.R. Kihel. – K.: Condor, 2003. – 158 p.
10. Moore D. Economical Modeling in Microsoft Excel / D. Moore, L. Wooderford – 6th ed.; translation from English. – M.: Williams, 2004. – 1024 p

УДК 519.85

Харченко Юрій Анатолійович, кандидат технічних наук, доцент. Полтавський національний технічний університет імені Юрія Кондратюка. **Економіко-математичне моделювання виробничої програми підприємства.** Проведено дослідження хлібопекарської галузі України, яка призначена для безперебійного забезпечення виробництва хліба, хлібобулочних та інших борошняних виробів у кількості, яка відповідає нормам державної продовольчої безпеки. Зроблено висновок, що у нинішніх умовах нестабільної політичної й економічної ситуації, актуальною задачею є впровадження суб'єктами господарювання економіко-математичних методів моделювання для обґрунтування управлінських рішень щодо розроблення виробничої програми підприємства.

Під час розв'язання поставленої задачі виконано аналіз ринку хліба Полтавської області. Виявлено, що у Котелевському районі одним із основних виробників є пекарня «Коровай» районного споживчого товариства. В умовах скорочення ринку у натуральному вимірі хлібопекарські

підприємства вимушені постійно розширювати номенклатуру й проводити модернізацію виробництва. Обґрунтовано необхідність формування оптимальної номенклатури продукції з урахуванням максимального задоволення потреб споживачів у якісній продукції та за умови оптимального використання ресурсів підприємства й отримання максимального прибутку.

Розроблено виробничу програму підприємства з використання сучасних інформаційних технологій та оптимізаційних економіко-математичних моделей. Управління номенклатурою продукції з позиції її збалансованості забезпечує прийняття якісних управлінських рішень щодо стратегії розвитку підприємства. За рахунок впровадження моделі підвищиться конкурентоспроможність і прибуток підприємств хлібопекарської галузі.

Ключові слова: економіко-математична модель, виробнича програма підприємства, пекарня.

UDC 519.85

Yurii Kharchenko, PhD (Technical Sciences), Associate Professor. Poltava National Technical Yuriy Kondratiuk University. **Enterprise production program economic – mathematical modeling.** Bread baking industry of Ukraine is studied in the article. It is concluded that during the current conditions the actual task is the implementation of economic- mathematical models in the production programs preparation.

While solving the task, Poltava region bread market analysis was carried out. It was revealed that one of the main producers of bakery products in the Kotelevskyi district is the bakery "Korovai". The necessity of formation optimum production stock list with the account of the maximum consumers' satisfaction and optimum enterprise resources usage is proved.

The company's production program has been developed using modern information technologies and optimization economic-mathematical models. The model introduction will increase industry enterprises competitiveness and profitability.

Keywords: economic-mathematical model, enterprise production program, bakery.

УДК 519.85

Харченко Юрий Анатольевич, кандидат технических наук, доцент. Полтавский национальный технический университет имени Юрия Кондратюка. **Экономико-математическое моделирование производственной программы предприятия.** Исследована хлебопекарская отрасль Украины. Сделан вывод о том, что в нынешних условиях актуальной задачей является внедрение экономико-математических моделей при составлении производственных программ.

В процессе решения поставленной задачи выполнен анализ рынка хлеба Полтавской области. Выявлено, что в Котелевском районе одним из основных производителей хлебобулочных изделий является пекарня «Коровай». Обосновано необходимость формирования оптимальной номенклатуры продукции с учетом максимального удовлетворения потребителей и оптимального использования ресурсов предприятия.

Разработано производственную программу предприятия с использованием современных информационных технологий и оптимизационных экономико-математических моделей. Внедрение модели позволит повысить конкурентоспособность и прибыль предприятий отрасли.

Ключевые слова: экономико-математическая модель, производственная программа предприятия, пекарня.