"Methodic tools to optimize marketing expenses of the innovatively active industrial enterprises in Ukraine"

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Methodic tools to optimize marketing expenses of the innovatively active industrial enterprises in Ukraine

Abstract

The efficient sales policy of the machine building innovatively active enterprises is connected with its rational process financing. Optimal determination of innovative production distribution expenses is top-priority element to increase economic subject's activity profitability and to increase its competitive positions at the market. Thus, planning of costs for innovatively active machine building enterprises sales has to be based on economic and rationally adaptive mathematic tools to industrial enterprises activity specific.

Practical implementation of the mentioned task is possible owing to economic and mathematic model to plan costs for innovatively active enterprises production, which preconditions urgency of the given research. Besides the tools investigation is also urgent and it allows to foresee future expenses amounts for sales, demand for production and profit of the innovatively active industrial enterprise, behavior in future depending on market situation.

The article deals with scientific and methodic approach to optimize distribution expenses of the innovatively active industrial enterprises in Ukraine. Economic and mathematic modeling methods allowed to formalize models to plan distribution expenses of innovatively active enterprise, demand and profits, that is prerequisite to form prognostications by proper directions.

Practical implementation of the suggested scientific and methodic approach on the example of machine building enterprise in Ukraine results in confirmation of models correspondence and establishment of inefficiency to distinguish expenses. It gives evidence about necessity to optimize expenses of enterprise and to introduce active managerial decisions concerning its activity profitability growth.

Keywords: sales, enterprise, machine building industry, investments, innovations, costs for innovations, optimization, prognostication, enterprise incomes.
JEL Classification: D24, L64, M31, O31.

Introduction

Efficient activity of the machine building enterprise under conditions of increasing competitiveness either on the part of native producers, or of foreign ones, provides new acts and means searching to grow profitability as the proper economic subject's further development factor. Introduction of the innovative projects is one of the important directions to use such modern actions and foresees to achieve several tasks, including: keeping of the standing customer; new sales market development; new good withdrawal to the market; optimization of enterprise expenses. Implementation of the mentioned tasks is oriented to increase enterprise competitiveness at the market and to improve its financial results.

Peculiarities of the innovatively active industrial enterprises development depend on initial expenses amounts, which are necessary for goods producing, on market development period duration or its proper segment, and also process of the market entry. Enterprise is supposed to be innovatively active, if it suggests improved production (technology); realizes concrete innovative project; conducts long-term innovative activity (e.g., fundamental researches); invests money into personal scientific and research and constructive works; carries out innovative projects and organizes other actions together with enterprises or scientific and research laboratories.

The efficient sales policy of the innovatively active enterprises production is connected with its financing rational process. Optimal determination of expenses to sale innovative production is top-priority element of the economic subject's profitability increasing element and its competitive position growing at the market. Thus, planning of distribution expenses of innovatively active machine building enterprises has to be based on the economic and rationally adaptive mathematic tools to machine building enterprise activity specific.

1. Analysis of the recent research and publications

Problems of enterprises' innovative development financing and as a result, economy at a whole, are actively discussed in works of leading native and foreign scientists. Among leading foreign specialists we may point out the following: G. Stuart [14], G.J. Bolt [3], A.A. Thompson and A.J. Strickland [15], G. Lancaster and D. Jobber [10], Afronin, I.V. [1], Ildiakov, A.V. [5], Perry, L.T. [12]. At the same time, native scientists have made great contribution into development of the scientific opinion concerning efficiency providing and optimization and balancing of distribution expenses of economic subjects' innovative production, among which are:

V.F. Hamalii [4], L.V. Balabanova [2], S.M. Illiashenko [6], A.V. Voichak [19], Roshylo V.I. [13], S.M. Kozmenko [7, 8, 9], T.A. Vasyll'eva [16, 17, 18], S.V. Lieonov [11] and many others. In their works the mentioned above scientists investigated conceptual grounds to form and to search innovations financing resources, sales policy forming postulates, its place in the system of enterprise management, peculiarities of the innovative production sales net etc. Technology and methodology to optimize distribution expenses of the innovative production has not been studied yet.

Thus, problem of the sales net potential increases under conditions of innovatively dynamic activity at the industrial enterprises, and formation of grounds to make managerial decisions concerning innovations financing, and accordingly costs optimal structure to sell innovative goods, requires profound studies. It becomes especially urgent under conditions of market positions losses by native industrial enterprises at some sales markets.

2. Task statement

The object of the article is to ground scientific and methodic bases of expenses optimization for innovatively active industrial enterprises production sales in Ukraine.

3. Main material

Planning of expenses for sale is one of the basic components in general marketing conceptions at the enterprise. Its goal is to make significant decisions by the authority for future, owing to present state analysis and its factorial space. At the same time managerial decisions have to be formed according to the proper optimal value of the controlled factor, which will provide high profitability and effective cash flows movement due to enterprises owners' needs.

Planning of expenses for sales is made through prognostication of external and internal enterprise space factors and expected incomes from innovative production realization, and also the given expenses financing. In this case it is reasonably to build economic and mathematic model to plan sales expenses. This model will ground relations between studied factors and will allow to foresee optimal sales expenses of the innovatively active machine building enterprise, which would provide achievement of the maximal profit in future. Achievement of the mentioned goal requires to realize three blocks of actions, demonstrated in Figure 1.

Identification of model variables and parameters provides distinguishing of its forming factors into incoming, uncontrolled and outgoing. Practical realization of the proposed approach is conducted according to data from LLC "Turbomash", which may be included to the innovatively active

machine building enterprises, because both goods production process and ready production include the innovative constituent.

Analysis of the sales policy factors dynamics at LLC "Turbomash" stipulated reasonability of the analyzed time interval division into two periods – 2010-2012 and 2013-2014. During 2010-2012 there are equal values of factors concerning LLC "Turbomash" activity in comparison with the following periods. Particularly, at this time little waves of the average price for enterprise production are observed, which is about 200 thousand hrn., data in 2011 are different (100-400 thousand hrn).
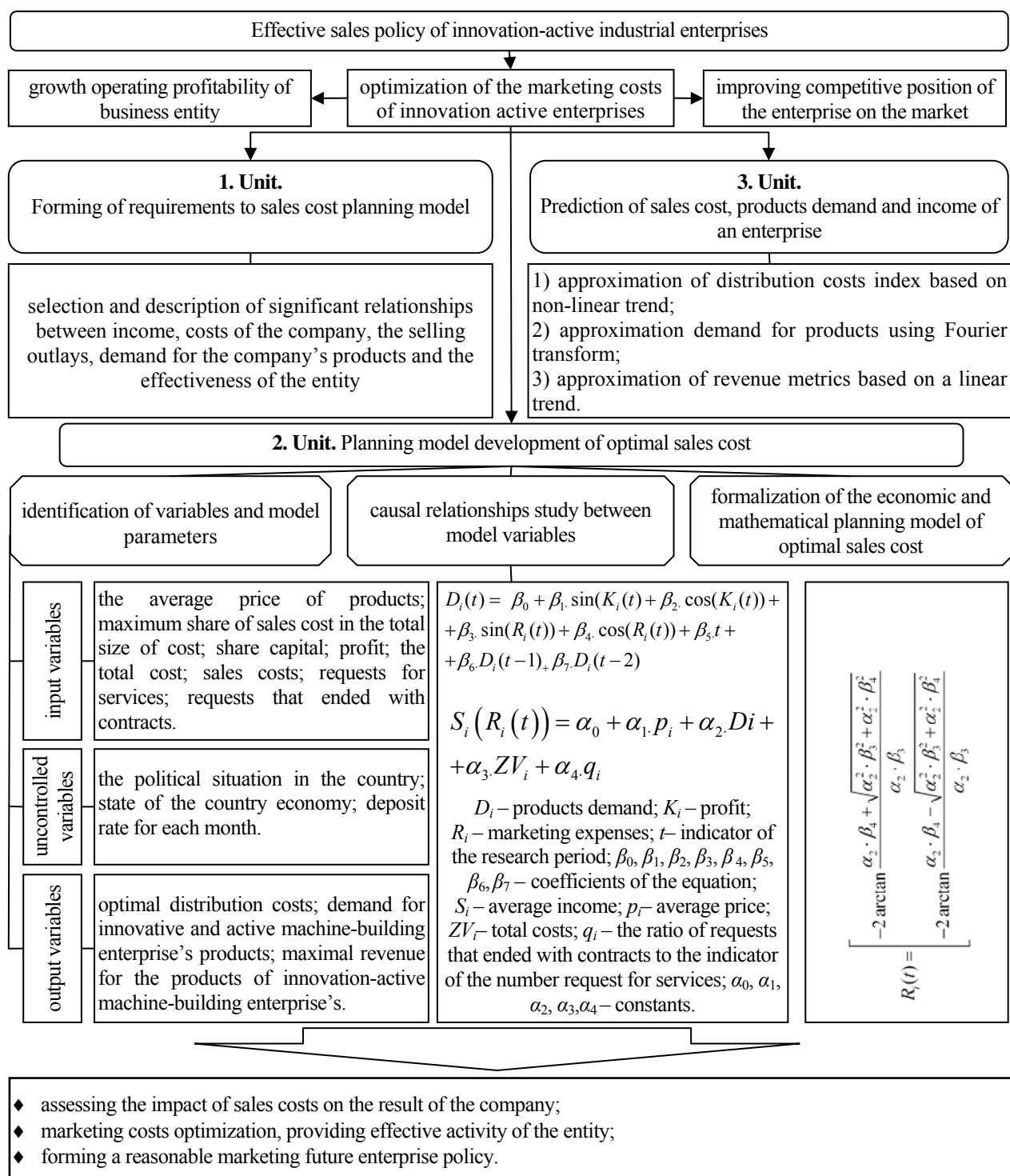
Dynamics of the enterprise total expenses is increasing, however sales policy financing is not at high level, during the proper term part of the sales expenses was 1%, but the third quarter in 2010 and first quarter in 2012 are exceptions, when the proper factor increased 3% of total expenses.

Investigating financial results, received by the enterprise during 2010-2012, one has to distinguish their equal character, however low profitability. At the same time, net financial result dynamics during 4th quarter in 2011–2d quarter in 2012 has negative value, connected with general expenses increase, average price decrease for production and expenses shortening in sales sphere. Mentioned situation confirms non-optimal expenses, which overestimate the produced goods prime cost and worsen its realization dynamics.

During 2013-2014 various changes are observed in factors of the average price for production, total expenses, their part in the structure of marketing expenses and incomes. Particularly, one has to point out the first quarter in 2013, during which total expenses fall is observed, however marketing expenses part is maximal at this period and is 8.5%, and increase of the average price for goods, that finally gives ability to get the highest value of net profit during the whole research. In general, considering the fact, that number of requests at the machine building production from LLC "Turbomash", which were finished with agreement signing, swings in little intervals? Enterprise activity results depend on price dynamics for production, and also dynamics and structure of expenses for goods production and realization.

Uncontrolled variables of this model include: political situation in the country; state of the country economy; deposit rate for every month.

Outgoing data include: optimal marketing expenses; demand for production of the innovatively active machine building enterprise; maximal profit for production of the innovatively active machine building enterprise.

| Effective sales policy of innovation-active industrial enterprises |

| growth operating profitability of business entity | optimization of the marketing costs of innovation active enterprises | improving competitive position of the enterprise on the market |

1. Unit.
Forming of requirements to sales cost planning model

3. Unit.
Prediction of sales cost, products demand and income of an enterprise

selection and description of significant relationships between income, costs of the company, the selling outlays, demand for the company's products and the effectiveness of the entity

1) approximation of distribution costs index based on non-linear trend;
2) approximation demand for products using Fourier transform;
3) approximation of revenue metrics based on a linear trend.

2. Unit. Planning model development of optimal sales cost

identification of variables and model parameters

causal relationships study between model variables

formalization of the economic and mathematical planning model of optimal sales cost

input variables

the average price of products; maximum share of sales cost in the total size of cost; share capital; profit; the total cost; sales costs; requests for services; requests that ended with contracts.

uncontrolled variables

the political situation in the country; state of the country economy; deposit rate for each month.

output variables

optimal distribution costs; demand for innovative and active machine-building enterprise's products; maximal revenue for the products of innovation-active machine-building enterprise's.

$$D_i(t) = \beta_0 + \beta_1 \sin(K_i(t) + \beta_2 \cos(K_i(t)) + \beta_3 \sin(R_i(t)) + \beta_4 \cos(R_i(t)) + \beta_5 t + \beta_6 D_i(t-1) + \beta_7 D_i(t-2)$$

$$S_i\big(R_i(t)\big) = \alpha_0 + \alpha_1 p_i + \alpha_2 Di + \alpha_3 ZV_i + \alpha_4 q_i$$

D_i – products demand; K_i – profit; R_i – marketing expenses; t – indicator of the research period; $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ – coefficients of the equation; S_i – average income; p_i – average price; ZV_i – total costs; q_i – the ratio of requests that ended with contracts to the indicator of the number request for services; $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ – constants.

$$R_i(t) = \begin{bmatrix} -2\arctan\frac{\alpha_2 \cdot \beta_4 + \sqrt{\alpha_2^2 \cdot \beta_3^2 + \alpha_2^2 \cdot \beta_4^2}}{\alpha_2 \cdot \beta_3} \\ -2\arctan\frac{\alpha_2 \cdot \beta_4 - \sqrt{\alpha_2^2 \cdot \beta_3^2 + \alpha_2^2 \cdot \beta_4^2}}{\alpha_2 \cdot \beta_3} \end{bmatrix}$$

♦ assessing the impact of sales costs on the result of the company;
♦ marketing costs optimization, providing effective activity of the entity;
♦ forming a reasonable marketing future enterprise policy.

Fig. 1. Scientific and methodic approach to plan optimal marketing expenses value of the innovatively active machine building enterprises

Marketing expenses may be supposed as controlled variable, because it may be changed depending on modeling stage.

As a result of factors analysis formalization for production at the enterprise there is cyclic demand for LLC "Turbomash" products. It means that annually investments into main capital of the industrial enterprises are increased till the fourth quarter. Therefore, tendency points for constant shifting of the curve up, and it confirms demand growth for enterprise production.

Enterprise incomes dynamics has complex character. At a whole, we can see the increasing character of this factor during period; however, there are several disproportions in the quarter connection, especially in 2013-2014. Main significant factors, which lead to such dynamics of enterprise profit, include total sum of expenses and price-wave for production.

The following step to implement the model is provided by formalization of the economic and mathematic model concerning development expenses planning of the machine building innovatively active enterprise. In order to define and optimize the given factor, one chooses Fourier function considering time effect.

Thus, Fourier function of the demand considering time effect is:

$$D_i(t) = f(K_i(t), R_i(t), t, D_i(t-1), D_i(t-2)) =$$
$$= \beta_0 + \beta_1 \cdot \sin(K_i(t)) + \beta_1 \cdot \cos(K_i(t)) + \beta_3 \cdot \sin(R_i(t)) + \quad (1)$$
$$+ \beta_4 \cdot \cos(P_i(t)) + \beta_5 \cdot t + \beta_6 \cdot D_i(t-1) + \beta_7 \cdot D_i(t-2))$$

where $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ – coefficients of the equation;

t – indicator of the research period;

$K_i(t)$ – profit of the i-enterprise;

$R_i(t)$ – marketing expenses of the i-enterprise.

$D_i(t)$ – demand for production of the i-enterprise – investments into main capital of the Ukrainian industrial enterprises, mln. hrn;

On the basis of the formed statistic data, we determine parameters of demand depending of LLC "Turbomash" production on profit and marketing expenses, time factor and demand for production in the previous time intervals (Table 1).

Table 1. Regressive statistics of research on demand depending for production from LLC "Turbomash" on profit and marketing expenses, time factor and demand for production

Factors	Coefficients	Standard margin	t-statistics	Down 95%	Up 95%
Y-cross	24837.31	7965.88	3.1180	7088.23	42586.40
sinK	5853.20	3603.05	1.6245	-2174.89	13881.28
cosK	6607.93	3720.36	1.7762	-1681.54	14897.40
sinR	-6353.12	2951.87	-2.1522	-12930.30	224.07
cosR	-3948.46	3561.56	-1.1086	-11884.11	3987.18
t	1210.54	662.98	1.8259	-266.68	2687.76
D-1	-0.2541	0.3878	-0.6552	-1.1182	0.6100
D-2	-0.4702	0.2315	-2.0308	-0.9860	0.0457

The results of modeling defined seasonal constituent, i.e. it is reasonably to use Fourier transformation to point out cyclic component.

Using the analogical approach, suitable econometric model of the LLC "Turbomash" profit was built, confirmed by: determination coefficient at the level of 0.9653 unit, i.e. enterprise profit variation for 97% is explained by the factorial features variation; Fisher's criterion, which is 104.33 units and exceeds critical level. Graphical presentation of the ratio between real data and regression empiric equation is demonstrated in Figure 2.
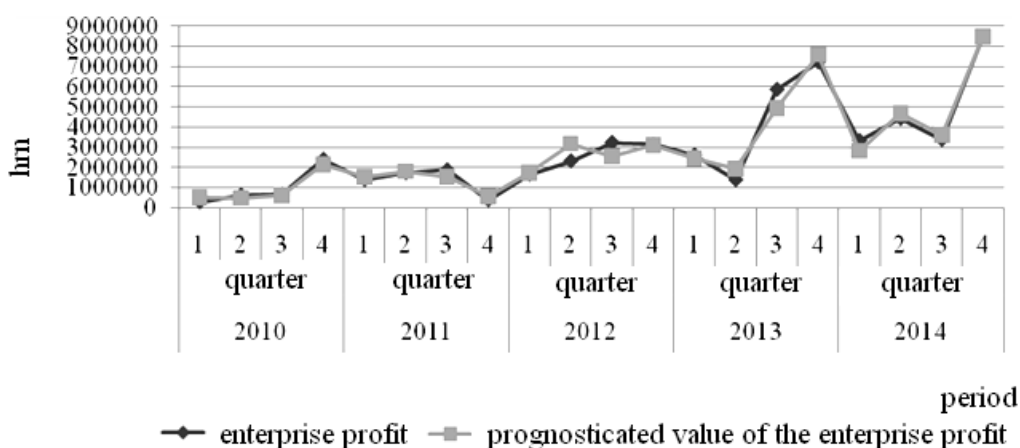

Fig. 2. Dynamics of the real and theoretical levels in LLC "Turbomash" profit due to quarter data during 2010-2014, hrn.

On the basis of data from Figure 2 we have to mention that with similar tendency in 2010-2012, there are great changes of profit level in LLC "Turbomash" in 3-4 quarters in 2013 and in 1-3 quarters in 2014. Quick profit increase in LLC "Turbomash" in 2-4 quarters in 2013 led to its shortening in 2014 and was the same as in 2012.

These changes were connected with political crisis in Ukraine at the proper period of time, particularly deterioration in relations with Russian Federation and the proper production sales market shortening.

Thus, making formalization of profit function at LLC "Turbomash" is ability to implement main goal

of the modeling, particularly marketing expenses at every enterprise maximize profit value in the period $t \in [t_0, T]$. Task of the enterprise profit optimization consists in choosing of the marketing expenses value at enterprise $R_i(t)$ in time interval $t \in [t_0, T]$, which provides maximal profit on conditions of management variables inherence and appropriation of $R_i(t)$ value not less than 8.46% (maximum possible level during 2010-2014). Let's find extreme points (equation 2).

$$R_i(t) = \begin{bmatrix} -2 \cdot \arctan \dfrac{\alpha_2 \cdot \beta_4 + \sqrt{\alpha_2^2 \cdot \beta_3^2 + \alpha_2^2 \cdot \beta_4^2}}{\alpha_2 \cdot \beta_3} \\ -2 \cdot \arctan \dfrac{\alpha_2 \cdot \beta_4 - \sqrt{\alpha_2^2 \cdot \beta_3^2 + \alpha_2^2 \cdot \beta_4^2}}{\alpha_2 \cdot \beta_3} \end{bmatrix} \quad (2)$$

Calculations provide optimal level of the marketing expenses at the level 61934.37 hrn., that is 9.72% of total expenses. Therefore, investments into main capital make 7781.73 million hrn., and maximal profit is accordingly 626657.01 hrn.

The final stage in this research is practical use of the investigated economic and mathematical model to prognosticate marketing expenses, demand and profit of LLC "Turbomash" for 2015 and 2016 within quarters. With purpose to realize the mentioned actions there is necessity, firstly, to approximate total expenses at the enterprise, which are demand function factor and in its turn, profit. That's why, we form Table 2 – the statistic set of data to determine total expenses function specification at LLC "Turbomash" and we calculate parameters of the econometric model through least square method.

Table 2. Regressive statistics to define total expensesfunction specification at LLC "Turbomash"

Factors	Coefficients	Standard margin	t-statistics	Down 95%	Up 95%
Y-cross	-277306.81	668030.16	-0.42	-1693467.49	1138853.87
t	281859.08	56008.08	5.03	163127.25	400590.91
sint	31833.12	444190.14	0.07	-909807.90	973474.13
cost	-670219.72	462353.93	-1.45	-1650366.25	309926.81

Thus, on the basis of data from Table 2 one can formalize total expenses function (ZV) LLC "Turbomash":

$$ZV_1(t) = -277306.81 + 281859.08 \cdot t + 31833.12 \cdot \sin(t) - 670219.72 \cdot \cos(t) \quad (3)$$

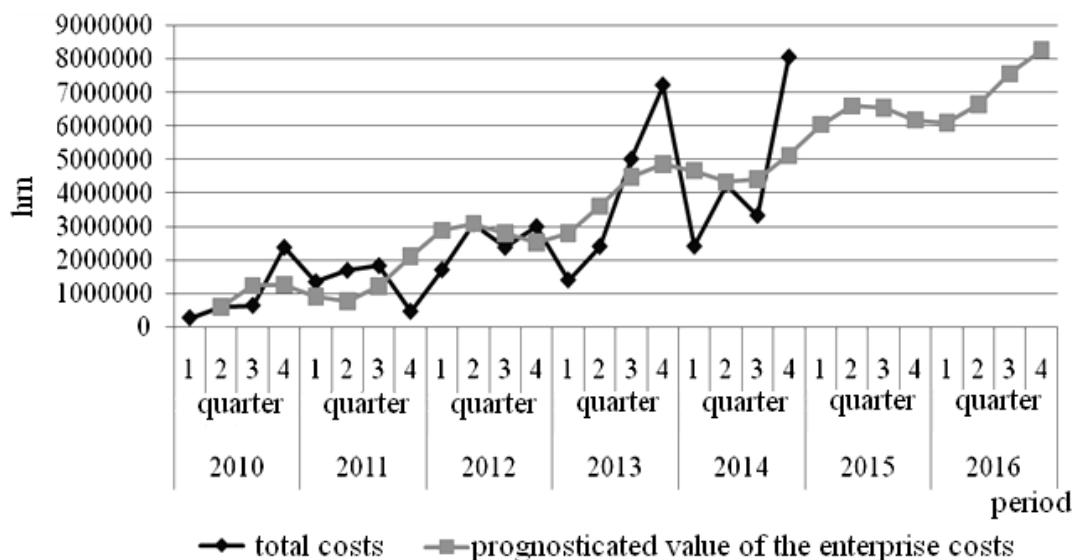We present prognosticated values, received on the basis of equation (3), in Figure 3.

Fig. 3. Dynamics of total expenses of real and prognosticated values at LLC "Turbomash" during 2010-2016 within quarters, hrn.

Investigating real data of the total expenses at LLC "Turbomash", we have to notice, that in spite of profit, enterprises expenses are increased faster and have lower trend, in spite of cyclicality till fourth quarter in 2014 included. This fact testifies the real necessity to optimize enterprise expenses and to introduce acting of managerial decisions concerning profitability increase in the LLC "Turbomash" activity.

Approximation of the profit factor is suggested on the bases of linear trend. This factor is necessary to define prognosticated values of demand function values for LLC "Turbomash" production during 2010-2016 within quarters. Thus, due to results of mathematic transformations, we receive the following prognosticated defined factors values (Table 3).

Table 3. Prognosticated values of total expenses, marketing expenses, demand and profit
of LLC "Turbomash" during 2015-2016 within quarters, hrn.

Year	Quarter	Factors			
		Total expenses	Marketing expenses	Investments into main capital	Profit of the enterprise
2015	1 q	6035466.15	586785.35	33589.25	6217453.45
	2 q	6593504.62	641039.46	28395.48	6787813.43
	3 q	6535629.37	635412.66	19725.70	6734641.78
	4 q	6174190.56	600272.54	39133.78	6354800.68
2016	1 q	6100633.32	593121.09	19889.10	6292564.70
	2 q	6641725.76	645727.65	47963.22	6824097.22
	3 q	7559129.93	734920.32	21456.68	7773429.19
	4 q	8268528.60	803890.10	28680.94	8489510.01
Optimal percentage of the marketing expenses in the total expenses at enterprise		9.72			

Conclusions

Investigating prognosticated marketing expenses values of the LLC "Turbomash", one can mention that cyclicality within quarter will be repeated in 2015, however in 2016 marketing expenses will have stable tendency for growing. Besides, it is necessary to mention that prognostication of marketing expenses was conducted considering their optimal value at the level of 9.72%. That's why, marketing expenses value in 2015 and 2016 exceeds average value of the given factor for the previous period more than ten times.

Analyzing future values of the demand values for production from LLC "Turbomash", we mention that this factor will be constantly increased during next 2 years, keeping clear cyclic tendency in every quarter.

The profit of the studied enterprise after fast growing in fourth quarter in 2014, prognosticated after little shortening, will save increasing tendency in 2015-2016.

The results of outgoing variables prognostication in economic and mathematic model to plan marketing expenses at LLC "Turbomash" allow to confirm that during next 2015 and 2016, keeping optimal part of the marketing expenses at the level of 9.72%, the given expenses will be increased owing to prognosticated increase in total expenses sum of the enterprise. Therefore demand factors for production will not change practically, although some breaches are observed in relation to the seasonal constituent, as it is observed by the real data. As a result of it, enterprise may expect for profit equal increase for prognosticated time interval.

Thus, economic and mathematic models use to plan marketing expenses of the machine building innovatively active enterprise empowers to describe relations between outgoing variables of the model, to estimate expenses' impact on sales on the received results in enterprise activity, to find optimal decision concerning the proper expenses and provide to ground financial and marketing policy at the enterprise.

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