ECONTECHMOD. AN INTERNATIONAL QUARTERLY JOURNAL – 2012, Vol. 1, No. 1, 27–32

Economic and Mathematical modelling of factors affecting the formation of competitive capacity of milk processing production

G.V. Cherevko

Lviv National University Agrarian in Dublany,
Ul. Wołodymyra Wełykoho, 1, m. Lwów-Dublany 80381 Ukraina,
Tel. 0-0380-32-22-42-936 (off.), +38-0680227072017 (kom.), E-mail: gcherevko@ukr.net

Received February 6.2012: accepted March 7.2012

Summary. The main results of the study present a practicable attempt for conducting the economic and mathematical modeling of the probable effect of the factors on formation the milk processing production competitiveness as the main factor of formation the competitiveness of the very milk processing enterprise under conditions of Ukraine's membership in WTO and sharpening the world economic crisis.

Key words: competitiveness, economic and mathematical modelling, factors, milk processing enterprise.

INTRODUCTION

Aggravation of competition under conditions of economic crisis and saturation the milk products market of Ukraine with foreign products makes the problem of raising the level of competitiveness of domestic milk processing enterprises to be the urgent question of the day. One of the objective ways to raise the level of competitiveness of these enterprises is to raise the level of competitiveness of their products that in return is affected by a number of other factors. The problem is that there are no well elaborated techniques for mathematical modelling of probable effect of these factors today that is considered to be a good ground for a proper investigation in this area.

RESEARCH ANALYSIS AND PUBLICATIONS

Such economists as G.Azoev, V.Andriychuk, L.Balabanova, P.Berezivskyy, R.Hlibov, F.Horbonos, Yu.Hubeni, A.Zheleznyak, S.Kvasha, Yu.Korobiv, V.Kudlay, M.Malik, V.Mesel-Veselyak, O.Nuzhna, B.Paskhaver, Zh.Poplavska, L.ramenskyy, V.Reutov, P.Sabluk, B.Supikhanov, R.Phathutdinov, S.Shevelyova have paid much attention to the problem of raising the competitiveness of milk production enterprises recently. S.Vasylchak, N.Havryshko, N.Holomsha, R.Dudyak, M.Ilchuk, M.Parhomets, V.Savytska, V.Topikha, S.Shevelyova, O.Shpychak, et al. dedicated their studies to particular issues of milk production market as well as to elaborating the mechanisms for developing the milk production sub-complex of Ukraine. Marketing aspects of milk production have been given much attention in the scientific publications of M.Andrushko, G.Astratova, R.Dudyak R.Blum, Ye.Dolan, T.Kenig, B.Klepatsky, F.Kotler, M.Sakhatsky, D.Stoner, J.Holey. It is also worth mentioning the young researches such as N.Botvina, I.Bulakh, N.Dmytrenko, T.Dobrunik, A.Zheleznyak, V.Korchahina, O.Lytvynova, R.Lupak, V.Martynyuk, A.Nikolayeva, R.Oleksenko, N.Olkhovska, O.Prus, I.Tsymbalyuk and some others who study particular elements of competitiveness of milk production enterprises. The dynamic changes in the conditions of economic activities that took place in Ukraine when it joined the WTO and because of sharpening of the world crisis requires profound and extended study that would enable to optimize the economic activity of milk processing enterprises in order to enhance their competitiveness on the foreign and domestic markets. To obtain more accurate results when conducting the research it seems reasonable to consider the feasibility to apply the economic and mathematical methods of modelling the influence of different factors on the formation of the rate of this competitiveness.

MATERIALS AND METHODS OF RESEARCH

During the study, a variety of contemporary methods of scientific research have been applied, abstract and logical and monographic being the main ones. Applying these methods made possible to conduct revision of the materials and publications related to the problem of competitiveness of milk production enterprises of Agro-Industrial Complex under conditions of the world crisis.

Due to statistical and economic method of research the structural and dynamic tendencies of the development of regional milk production sub-complex have been evaluated. The method of scientific abstraction and the method of analysis and synthesis made possible to generalize the obtained information and to make conclusions that have been valuable for science and practice. The list of references includes the works of economic researchers who study the same problems as well as the relevant official statistical data. The principles of economic and mathematical modelling of economic processes and events have been applied in practice.

THE PURPOSE OF THE STUDY

The main purpose of this paper is to present the results of probable application of economic and mathematical modelling in order to study the effect of factors on formation of milk processing enterprises' competitiveness as the main factor for formation of competitiveness of this type of enterprises under conditions of Ukraine's membership in WTO and general economic crisis.

THE RESULTS AND DISCUSSIONS

The development of economy has always been accompanied by the competition that's why competition as a phenomenon has a very distinct historical character. «From the point of view of horizontal structure, control of one enterprise creates conditions for monopoly and functioning of a large number of totally independent companies under conditions of market coordination provides conditions for perfect competition» [19]. J.S.Mill wrote about competition that «taking into account that competition is the only regulator of prices, wages and rents it is a law all by itself and it sets the rules of its regulation» [2]. And a representative of neoclassic school A.Marshall defined competition as a competition «… between two persons that compete especially when selling or buying something» [1].

Considering competition as a specific rivalry in the surrounding of salesmen or in the surrounding of buyers among themselves for the place on the market or for conditions of purchasing or selling the product, A. Smith just formulated his famous principle of "invisible (hidden) hand" as a principle of competitive struggle and survival under market conditions [4].

All the history of economic development can be viewed as a history of competitive struggle [17]. The company is successful in competitive struggle due to its competitive advantages, which are treated by different scientists in different ways. The concept of competitive advantages was first developed by Professor M.Porter. In his works he thoroughly analyzed the factors that would provide the competitive advantage for the company when applying them [11].

Directions for formation the competitive advantages of a company in fact are the grounds for formation the desired level of its competitiveness that can be understood in two ways, i.e. as an economic category and as a characteristic of a particular enterprise.

Company's competitiveness as a category does not exist separately from other economic categories which characterize the company's conditions at a specific moment or describe the perspectives of company's development.

So, the efficiency of the enterprise (the efficiency here is more likely to be considered as a social economic category) will have a direct effect on competitive positions of this particular enterprise on the market and it will make these positions stronger, in other words competitiveness of the enterprise at this very moment is presented in its competitive position on the market.

In a very broad meaning M.Porter defines competitiveness as «possibility to win in a competition», and in economics «possession of qualities that provide advantages for the subject of economic competition», and «different objects by origin - types of products, enterprises and organizations, their groups…» [10, p.138] can possess these qualities. A somewhat similar approach was presented by R.Phathutdinov who considered competitiveness as «…characteristic of an object that describes degree of satisfaction of a certain demand in comparison with better analogues presented on this market» [15].

The results obtained when investigating the concept of "competitiveness" logically led us to necessity to consider "competitiveness" on different levels [20]. The hierarchy of the objects of competitiveness may logically have the following order:

– competitiveness of a commodity (service), (products);
– competitiveness of an enterprise;
– competitiveness of a branch (production);
– competitiveness of a country.

Moreover the content of the concept of competitiveness on each level has its distinguishing features.

Competitiveness of the enterprise can be defined as «its ability to compete successfully and to win» [16]. According to the functional approach when studying the enterprise's competitiveness, its level depends on the level of organizational work of all its divisions and services, and the operational efficiency of these subunits depends on the efficiency of the use of enterprise's resources, i.e. competitiveness of the enterprise is the function of all its internal resources [5]. In other words, competitiveness of the enterprise depends on a large number of internal and external factors that dictate the application of a systematic approach to investigation of their influence. [13]. «Certainly, there is a possibility of combination the efficient economic activity and effective competitiveness. But the enterprise may demonstrate competitive advantages on some market segments and have low economic indices. On the other hand, high economic efficiency of the enterprise does not provide competitive advantages» [19]. Though, «high competitiveness of the company is a condition to obtain high profit under market conditions» [18], «but in case when the production costs are as low as possible, when available resources are rationally used then domestic producers can start fighting for the markets for their products» [18].

On the basis of analysis of the content of above mentioned and other approaches regarding the very core of the subject of competitiveness of enterprise, taking into account the very rational thought that «competitiveness of economic object shows its capability» [8], and also that «competitiveness … can be evaluated only by means of comparison » [6]. we may formulate it as a category that demonstrates economic relations among enterprises regarding their capability to be presented on the market of the particular products due to their competitive advantages when compared to their competitors.There are grounds to define the competitiveness on the level of an enterprise as a capability of this enterprise to compete with the similar enterprise under any conditions. In other words, it means to be profitable for a long time on the market of similar products and to achieve goals using its competitive advantages due to a number of corresponding factors such as competitiveness of products, technologies and equipment, personnel, management and organization of business.

On the basis of conducted research we have come to the conclusion that the key factor of the competitiveness of the enterprise under any conditions is in fact the competitiveness of the products of this enterprise.

Regarding the competitive capacity of products there are different approaches. Milk is a unique food product, that has not been synthesized in the world by now. It has no analogues among the food products as to its content [12]. 40% of energy and protein a human receives from milk and milk products during his life [3]. American researcher К.Ekls wrote: ”Milk can substitute any product but there is no product that could substitute milk” [7]. Competitiveness of products is understood as a quality of this product to ensure a commercial success under conditions of competition [9]. Competitiveness regarding the particular kind of product involves its qualitative and price characteristics [14]. When analyzing the results of different approaches to the understanding the very meaning of product’s competitiveness in order to determine the milk competitiveness as an outcoming product of milk processing enterprise we can treat it as combination of its qualitative and valuable characteristics that make this product being capable to better meet the demands of customers in comparison with the same kind of products on the market under conditions of competition. The level of products’ competitiveness is made up of many factors, quality and price being the most essential ones. These factors are derivative from a big number of facts and processes, some of which can be mathematically modeled. These can be the level of high quality raw materials base and the quality of managing the material flows that both have effect on quality and price of the finished product and its position on the market.

The research has been conducted on the basis of regional milk production sub complex of AIC (Agro Industrial Complex) that within the whole administrative region include milk producers and milk processing enterprise.

The method of mathematical modelling for managing the material flows (in this case these are raw materials) under conditions of equal income of milk raw materials from the producers to the processing enterprise has been studied.

According to the standard and operational information we calculate the structure of transaction costs which include the transportation costs of the raw materials to the enterprise; costs for unloading and documentation; costs for expansion of raw materials base (as an option of economic relation); payment of managerial staff taking into account that constant costs for purchasing of raw materials for the given season (can be a year) account to a corresponding amount C_0 hrv per ton , and the costs for storing and refrigerating etc., – C_1 hrv per ton for a season.

In summer time milk processing enterprises mainly operate when they are relatively well supplied with raw materials which are delivered,

in constant intervals of time:

$$t = t_i - t_{i-1} = const, \tag{1}$$

In this approach:

$$t = \frac{T}{\eta}, \tag{2}$$

where: η – number of delivery of raw milk for the period T (days):

$$n = \frac{V}{q}, \tag{3}$$

where: q – average amount of milk per one delivery:

$$S_1 = C_0 n = \frac{1}{q} C_0 V = \frac{C_0 V}{q}, \tag{4}$$

$$S_2 = \frac{C_1 q T}{R}. \tag{5}$$

Organizational expenses (S_1) and the costs for storing and refrigerating milk at different stages of technological process (S_2).

Total amount of transaction costs for the whole season will make up:

$$S = S_1 + S_2 = \frac{1}{q} C_0 V + \frac{C_1 T}{2} q. \tag{6}$$

The enterprise is aimed to minimize these costs that can be calculated as follows:

$$S_{мін} = \sqrt{2 C_0 C_1 V T}, \tag{7}$$

and optimal meaning of $q_{опт}$ can be calculated in the following way:

$$q_{опт} = \sqrt{\frac{2 C_0 V}{C_1 T}}. \tag{8}$$

The necessary financial resources for covering costs for transportation and initial storing the raw milk can be

calculated with the formula (4) and (5), and the calculations show that their amount typically accounts to ½ of value $S_{\min}$.

The predicted values of raw milk amount on average per day for the period of the highest milking productivity of cows are recommended to be calculated with formula:

$$\overline{x} = \frac{q_{\min}}{t}. \tag{9}$$

In order to predict the necessary amount of transport means to supply the necessary amount and steady income of raw milk *($P_{вп}$)*, we need to apply the meaning of the number of trips of one vehicle, load carrying capacity and the average distance for delivery the milk to the processing enterprise:

$$N_a = \frac{\overline{x}}{kP_{вп}}. \tag{10}$$

In a similar way we can calculate the necessary amount of labor force applying standard labor costs for processing 1 ton of raw milk:

$$N_a = \overline{x}R. \tag{11}$$

To be able to analyze the tendencies for milk supply over the year and particular seasons, it is advisable to apply the statistical methods for processing these dynamic rates:

$$\overline{x}_i = \frac{x_{i-1} + x_i + x_{i+1}}{3}, (i = 1,...n), \tag{12}$$

where: x_i - 24 dol. volume of raw milk income,

$\overline{o}_3$ - adjusted meaning of 24 hr volume of raw milk income.

The results of calculations show that the volume of raw milk income over a number of seasons has been of parabolic character:

$$\overline{x}_i = a_0 + a_1 t + a_2 t^2, \tag{13}$$

where: t - unit time, then t = i=1, 2,..., η, and the duration of the season will amount $T = \eta$ days.

Parameters a_o, a_x, a_2 have been determined by application the method of the least squares:

$$\begin{cases} a_0 n + a_1 \sum t + a_2 \sum t^2 = \sum \overline{x}_i, \\ a_0 \sum t + a_1 \sum t^2 + a_2 \sum t^3 = \sum t\overline{x}_i, \\ a_0 \sum t^2 + a_1 \sum t^3 + a_2 \sum t^3 = \sum t^2 \overline{x}_i. \end{cases} \tag{14}$$

The system of regular equation as to a_o, a_1, a_2 is solved by applying the Cramer rule, and the obtained equation of regression allows to determine the calculated meanings of the average income of raw milk to the processing plant $\overline{o}_3$.

The calculations made on the basis of the data obtained from Joint Stock Company «Halychyna» in Radekhiv district, Lviv region, have proved the parabolic character of the dynamics of the raw milk volume income and confirmed the high value of the correlation coefficient (R=0,897). Thus, the equation for the tendency of raw milk income in 2009 applying this correlation coefficient is the following:

$$\overline{x}_t = -349,72 + 242,64t - 3,01t^2, \tag{15}$$

and in 2010 with the correlation coefficient R=0,979,

$$\overline{x}_t = -152,94 + 164,51t - 1,49t^2. \tag{16}$$

The conducted computations demonstrate that using only the one year period data there is no sense to apply the obtained equation regarding the tendency of raw milk supply because it is evident that the coefficients used have not been a function of sporadic factors and often these factors can be regulated (e.g. milking productivity of cows).

That's why it is advisable to consider the coefficient calculations a_o, a_1, a_2:

- taking into account the following factors:
- the expected volume of raw milk *V(т)*,
- volume of raw milk at the beginning of the season $t_0 = 0$ $\bar{o}_0$ (т),
- volume of raw milk in the end of the season $t_n = T$, $\bar{o}_n(T)$.

Initial data for the calculations of the values of the above mentioned volumes are the cows' productivity and outcome of milk from each herd and producer and the normative standards for processing every ton of raw milk.

So, at the moment of time $t_0 = 0$ applying the equation:

$$\overline{x}_0 = x_{t_0=0} = a_0 + a_1 \cdot 0 + a_2 \cdot 0 = a_0, \tag{17}$$

we: can calculate that $a_0 = \overline{x}_0$.

And at the time $t_n = T$:

$$\overline{x}_n = x_{i=T} = a_0 + a_1 T + a_2 T^2, \tag{18}$$

that is:

$$\overline{x}_n = a_0 + a_1 T + a_2 T^2.$$

The total volume of raw milk, that is transported for the time *[0,T]* will be:

$$V = \int_0^T (a_0 + a_1 t + a_2 t^2) dt = a_0^T + a_1 \frac{T^2}{2} + a_2 \frac{T^3}{3}. \tag{19}$$

By combining the equations (3.17), (3.18) and (3.19) into the system of equation in three unknown a_o, a_1, a_2 we can get:

$$\begin{cases} a_0 = \overline{x}_0 \\ a_1 = \dfrac{2}{T^2}\left[3V - T(2\overline{x}_0 + \overline{x}_n)\right] \\ a_2 = \dfrac{3}{T^3}\left[T(\overline{x}_0 + \overline{x}_n) - 2V\right]. \end{cases} \tag{20}$$

As a means of solution of such a system of equations it is advisable to consider the correlation:

$$\begin{cases} \overline{x}_n = a_0 \\ \overline{x}_n = a_0 + a_1 T + a_2 T^2 \\ V = a_0 T + a_1 \dfrac{T^2}{2} + a_2 \dfrac{T^3}{3}. \end{cases} \quad (21)$$

The average value of the volume of raw milk income at every moment of time t in the period $[0,T]$, can by calculated by means of the following equation:

$$\overline{x} = \overline{x}_0 + \frac{2}{T^2}\left[3V - T(2\overline{x}_0 + \overline{x}_n)\right].$$

$$t + \frac{3}{T^3}\left[T(\overline{x}_0 + \overline{x}_n) - 2V\right]t^2. \quad (22)$$

In case of applying the presented method of calculations in other enterprises you must apply the corresponding variation coefficient to correct the meaning:

$$\delta = \frac{\zeta}{x}, \quad (23)$$

where: x is the average volume of raw milk supply for 24 hrs over the season calculated with method of the least squares;

ζ – mean square deviation of random variable x_n,

ζ – mean square deviation of random variable x_n.

The value ζ can remain unvarying over the future period in case of negligible changes of values of its random factors. But in case of required correction of one of the important criteria the change of coefficients a_o, a_1, a_2 will be obligatory , that will cause the automatic reviewing of criteria meanings:

$$\overline{x}_0^{'} = \overline{x}_t;\ \overline{x}_n = \overline{x}_T, \qquad t=0\ \ T=T', \qquad V' = (V - \sum_{t=1}^{t} \overline{x}_t).$$

Corrections mean taking into account the volumes that have already been stored up by the moment of time í (even in the form of dry milk).

The conducted corrections of calculations will in turn have effect on the volumes and rates of the whole amount of works fulfilled in the enterprise.

In the same way we can calculate the future amount of necessary vehicles and workers under condition of available calculated standards and application of Poisson's law, i.e. distribution law of random variable:

$$P_k(t) = \frac{\lambda^k e^{-\lambda t}}{k!}, \quad (24)$$

κ – number of vehicles κ = 0,1,2,....;

$P_k(t)$ – probable κ-income of vehicles per unit of time t;

e - – Napierian base (ϵ = 2,71828).

κ – number of vehicles κ = 0,1,2,....;

$P_k(t)$ – probability κ- of vehicles' per unit of time t;

e – Napierian base (ϵ = 2,71828).

The time for service of one vehicle is calculated in the same way:

$$P = (\tau \rangle t) = e^{-\mu t}, \quad (25)$$

where: $P(\tau > t)$ – probable excess of time t time interval τ between regular trips of vehicles.

The conditions presented in mathematical modelling are much harder than they can be in real life thus providing a certain "safety factor" for estimation the operation of the system.

With the aim of further mathematical formulation of considered dependences we indicate: the average number of vehicle units as λ; the average number of vehicle units that are unloaded per unit of time – as μ:

$$\mu = \frac{1}{\overline{t}_{обс.}}, \quad (26)$$

where: $t_{обс}$ – the average time for servicing one vehicle unit;

μ - number of unloading places;

$a = \dfrac{\lambda}{\mu}$ - loading level of enterprise.

Then:

– probability value that all milk pick up points are out of operation:

$$P_0 = \left[\sum_{k=0}^{n} \frac{a^k}{k!}\right]^{-1}, \quad (27)$$

– probability value that κ milk pick up points perform unloading of vehicles:

$$P_k = \frac{a^k}{k!} \cdot P_0, \qquad (1 \le k \le n) \quad (28)$$

– the average number of unloading places in milk pick up points:

$$N_3 = \sum_{k=1}^{n} k P_k, \quad (29)$$

– number of unused places at the operational milk pick up points:

$$N_{ïô} = n - N_3, \quad (30)$$

– milk pick up point working index:

$$k_{пр} = \frac{N_{пр}}{n} \cdot 100\%, \quad (31)$$

– coefficient of idle periods in a milk pick up point:

$$k_3 = \frac{N_3}{n} \cdot 100\%, \quad (32)$$

– idle periods probability before unloading:

$$P_{оч} = \frac{a^n}{n!} P_0, \quad (33)$$

– average number of vehicles standing idle before unloading:

$$\overline{m} = \lambda \cdot P_{оч}. \quad (34)$$

Then the total amount of financial losses of milk processing enterprise as a system will include losses from idle hours of vehicles and losses from underuse of operational milk pick up points:

$$S = \overline{m} C_T + N_{пр} C_б, \quad (35)$$

where: C_T – is money equivalent of the value of standing idle of a vehicle unit, hrv/dol.; $C_в$ – is money equivalent of the value of underuse of one operational milk pick up point, hrv/dol.

Let's estimate the operation of milk pick up points of a Joint Stock Company «Halychyna»:

– income intensity of vehicles with raw milk, λ = 5 units/dol,
– the average time for unloading of one vehicle unit at MPP (milk pick up point), $t_{обс}$ = 5 minuts, i.e. μ = 10 units/dol,
– the value of idle hours of one vehicle unit make out C_T = 105 hrv/dol,
– the value of underuse the operational capacity of one MPP, $C_в$=215 hrv/dol.

The most wide spread conditions for using the operational capacities of milk pick up points are the ones that correspond to n = 5, 6,7,8,9 and 10.

Then, for example, when $n = 7$ the losses of enterprise make out S_7 =2146,3 hrv/dol. When we set up two more milk pick up points at each enterprise, that is n = 9, then losses from inefficient unloading make out S_9 =1446,3 hrv/dol, and the economy cuts per hour will be $\Delta S = S_7 - S_9$ = 700 hrv/dol.

CONCLUSIONS

The hierarchy character of dependences between the level of competitive capacity of the enterprise and its products and different rates of factors of this level specifies the structure and block character of economical and mathematical model in order to optimize this level of products' competitiveness taking into account the organizational and legal type of economic activity of the producer. Application of the economical and mathematical modeling for providing the products' competitiveness must become an integral part and instrument of the system for controlling its level. The suggested approach for analyzing MPE (milk processing enterprise) operation makes possible to apply the mathematical model for more effective management than under real conditions. Making regulations and adjusting the presented and formal indices, studying possible results we provide conditions for development of automated monitoring system aimed at making managerial decisions regarding the organization of MPE business and milk processing enterprise in general to ensure the higher level of their competitiveness.

REFERENCES

1. **Azoev G.L.** Competition: analysis, strategy and practice. - M.: Center of Economics and Marketing, 1996. – 298 p.
2. **Azoev G.L.** Competition: theory and practice. - M.: Center of Economics and Marketing, 1998. – 308 p.
3. **Dobryanskyy V., Talko G., Ivanov V.** Albumenmilkness – the problem of general state importance // Proposal. – 2004.- №10. – P. 90–91.
4. **Drahan O.I.** Management of competitive capacity of the enterprise: theoretical aspects. Manuscript. –K.: DAKKKiM, 2006. – 144 p.
5. **Kapitanets Yu.M.** The methodology of estimation the competitive capacity of the enterprise // Newsletter of Pry Carpathian university. Economics. Issue # 5. - 2007. – P. 131–134.
6. **Kvasha S.M., Holomsha N.Ye.** Competitiveness of domestic agricultural products on the world agrarian market // Economics of AIC. - 2006.- №5. – P. 99–104.
7. **Kolot I., Korovnikov H.** Production of milk must be profitable // Proposal. - 2004. - №12. – P. 82–83.
8. **Koretskyy B.M.** Grounds for establishing the methodology algorithm for estimation the competitive position of the subject of economic activity in transit economy // Investments: practice and experiences. - 2008. - №5. – P. 39–44.
9. **Olkhovska N.A.** Methods of estimation the competitive capacity of agricultural products // Economics of AIC. - 2008. - №11. – P. 116–119.
10. **Porter M.** Competitive advantage: creating and providing the higher level of business activity. - New York: Frn-Press, 1995. – 757 p.
11. **Porter M.** International competition: Translation from Eng. / Edited and foreword by V.D.Shchetinin. - M.: International relations, 1993. – 896 p.
12. **Savytska V.H.** Milk and milk products in consuming balance of the population of Ukraine // Economics of AIC. - 1999. - №12. – P. 39–44.
13. **Seleznyova O.V.** Methodological grounds for estimation the competitive capacity of the enterprise // Economics and state. - 2007. - №6. – P. 31–33.
14. **Supikhanov B.K.** Raising the competitiveness of agricultural production under conditions of joining WTO // Economics of AIC. - 2007. - №5. – P. 44–49.
15. **Phathutdinov R.A.** Competitiveness: economics, strategy and management. - M.: INFRA-M, 2000. – 311 p.
16. **Hayek F.** Competition as a procedure of opening // Issues of Philosophy. - 1989. - №12. – P. 6–14.
17. **Tsarenko O.V.** Genesis of concept and methods for managing the competitiveness of the enterprise. // Economics and state. - 2007. - №8. – P. 53–56.
18. **Shevelyova S.O.** Competitiveness of milk sub complex. Manuscript. - Ternopil: Zbruch, 2001. – 408 p.
19. **Shkolnyy O.O.** Organizational and economic mechanisms of managing the competitiveness of agrarian enterprises. Manuscript. – Uman : Published by Uman SAU, 2007. – 308 p.
20. **Shpanko A.** About the content of the concept "Strategic competitiveness // Economics of Ukraine. - 2007. - №6. - P. 45–49.