UDC 504:621

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THE ECOLOGICAL COMPONENT OF POTENTIAL OF SUSTAINABLE DEVELOPMENT OF MACHINE-BUILDING ENTERPRISES AS A MANAGEMENT INSTRUMENT BY A COMPETITIVENESS

Statement of the problem. In the period of globalization of economic processes into sustainable development of industrial enterprises one of the significant roles is played of their ecological component and the choice of strategic aims of management of sustainable development and coordination of a business - processes to envisage the processes of integration of the national economy into the united international economic system.

Machine – building enterprise has to consider global processes in the economic space. Under such conditions complex increase of enterprise competitiveness on the basis of ecological marketing and innovative development has to be done. Special attention should be paid to its place determination in general competitive space. Activity of machine-building enterprise is connected with harmful influence on the environment by various factors, namely: emissions into atmosphere, water and land pollution, noise pollution etc. Under conditions of European integration of Ukraine and arrangement of strict ecological requirements for machine-building machine - building enterprises the problem of ecological indicators improvement is of great importance. Imperfect functioning of machine - building enterprises in ecological problems solving cause the topicality of this research, namely formation of the model of sustainable development of enterprises on purpose to increase their competitiveness.

Analysis of the latest researches and publications. The algorithm of management "competitive space" modeling for industrial enterprises to control of cost is shown in the works [2,3] of Ye.F. Kalinina (Kalinina, 2007, p. 119-120) and A.S. Kuznetsova (Kuznetsova, 2007, p.131). The model of formation of competitive-price space for functioning the international business entity is presented in the works [4] of O.V. Ilyenko (Ilyenko, 2013, p. 140-145). However, the problem of sustainable development and of competitiveness control modeling for machine-building enterprises taking into account the ecological factor leaves much to be solved. The algorithm of economic systems modeling and problems of sustainable development has been researched by the following foreign and Ukrainian scientists [1-7]: B.J. Sovetov (Sovetov, 2001, p. 140-143), S.A. Yakovlev, V.V. Rosen (Rosen, 2002, p. 196), M.V. Gracheva (Gracheva, 2005, p. 18-27), S.A. Minyk (Minyk, 2002, p. 5-13) and others.

The purpose of the article is model making for parameters control of competitiveness concentrating attention on ecological component of sustainable development of enterprises.

Presentation of the baseline of the studyMain results of the research. The use of economic-mathematical instruments of sustainable development for competitive profile presentation of the enterprise as three-dimensional space would be chosen as the best area of competitive environment modeling for machine-building enterprise.

Russian researchers Ye.F. Kalinina (Kalinina, 2007) and A.S. Kuznetsova (Kuznetsova, 2007) used this technique for expenses control of "ideal" product. They used a limited number of indicators for goods as well (only specialists of the enterprise took part in the info base forming without accounting customers' points of view and their attitude to goods).

From mathematical point of view three-dimension space is presented in the form of pyramid (Sovetov, 2001; Rosen, 2002; Gracheva, 2005; Minyk, 2002; Itzkov, 2009; Pickover, 1999; Rucker, 1984), the algorithm of systems modeling "Three dimension space" [1-10] has been researched by the following foreign and Ukrainian scientists and on the basis of this mathematical approach it offered by us [11, 12] to make the model of competitive environment (Fig. 1) for enterprise NKMZ (Novokramatorsky mashinostroitelny zavod/Novokramatorsky mashine-building plant).

NKMZ is an enterprise with a wealth of experience in participation in the large-scale national and international projects. Over the period of more than eight decades NKMZ has been creating their own design-and-engineering and processing schools to produce one-of-a-kind and serial machines many of which feature masterworks of the world machine-building industry. While constantly improving the products of their traditional nomenclature, NKMZ at the same time provides the market with the wide range of novel solutions.

The parameters of "competitive space" NKMZ are defined within the enterprise:

Y axis – competitiveness (K) of enterprise - degree of conformity of economical activity of the company to the requirements of target customers in comparison to the competitors;

Z axis – innovative activity (I) of the enterprise - stage (ability and readiness) and effectiveness of new technologies implementation into economical activity;

X axis – social factor and ecological activity (E) of the enterprise – stage (ability and readiness) and effec-
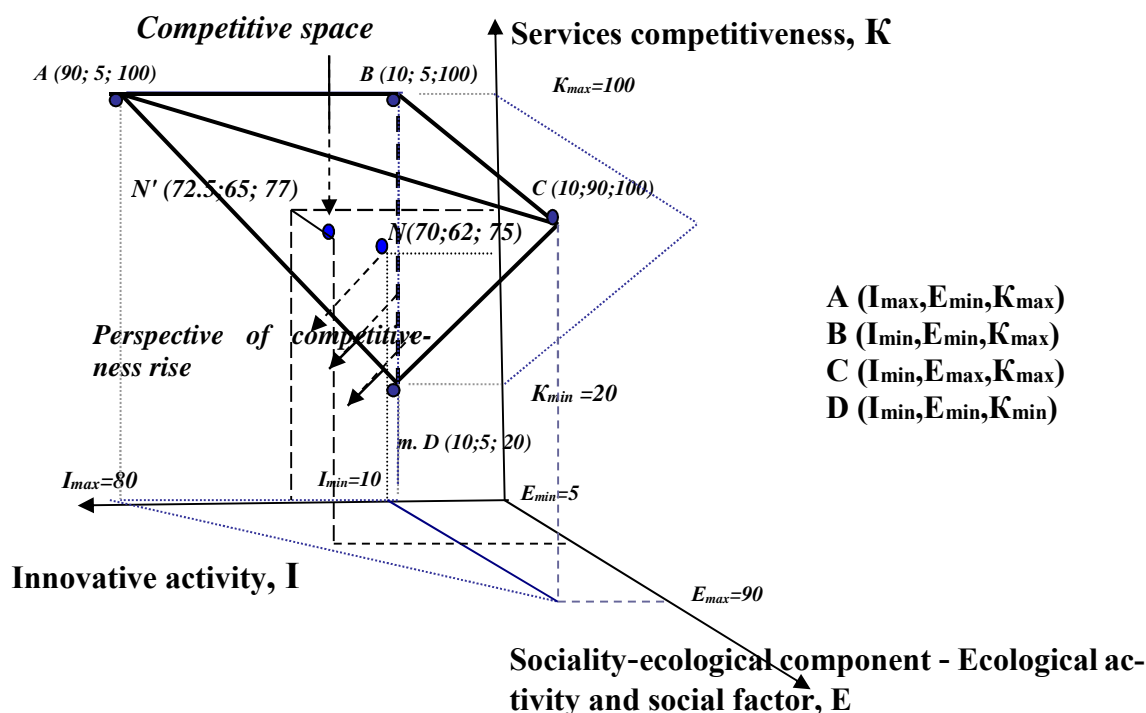
**Fig. 1. Change of position of machine-building enterprise NKMZ
towards the perspective of competitiveness rise**

Source: authoring.

tiveness of ecological programs development and realization at the enterprise according to the present requirements of ecological safety.

When estimating these parameters it is necessary to carry out full-fledged analysis of all the components on the basis of expertise. Positioning process of enterprise in competitive space:

$$I_{min} \le I \le I_{max}, \ E_{min} \le E \le E_{max}, \ K_{min} \le K \le K_{max}. \quad (1)$$

If $I_{min} \le I \le I_{max}$, $E_{min} \le E \le E_{max}$, $K_{min} \le K \le K_{max}$ (f(0,0,0)>0, f(I,E,K)>0, f(0,0,0) <0, f(I,E,K)<0), the plant is in the "space of competitiveness". It is necessary to form development strategy of the enterprise (according to estimation results). If this requirement is not fulfilled, the enterprise is outside the "competitive space". So, it is necessary to carry out the analysis of external and internal environment, elicit "gaps" in the activity and define lines of further development. If the enterprise moves to the "perspective of competitiveness rise" area, space parameters move to optimal level of enterprise competitiveness and its innovation for all low scale of negative influence on the environment.

Maximum and minimum parameters for competitive space were defined by the experts in order to estimate the international NKMZ (Novokramatorsky mash-

inostroitelny zavod/Novokramatorsky mashine-building plant) (considering the best and the worse estimation): I_{max} was defined at 90-point level, I_{min} is 10, E_{max} is 90, E_{min} is 5, K_{max} is 100, and K_{min} is 20.

Equation for NKMZ passing through three points:

$$f(I, E, K) = (I - I_{max})*(E_{max} - E_{min})*(K_{min} - K_{max})-$$
$$-(K - K_{max})*(E_{max} - E_{min})*(I_{max} - I_{min}) - (E - E_{min})* \quad (2)$$
$$*(I_{max} - I_{min})*(K_{min} - K_{max}).$$

Thus, optimal function defines the competitive space of the enterprise:

$$f(I; E; K) = f(70,2;62,1;75,1) \quad (3)$$

The check up proves that the NKMZ is in "competitive space" (Picture 1), because the following conditions are complied:

- according to the parameters of innovative activity: 10<70.2 <80;

- according to the parameters of ecological activity: 5< 62<70;

- according to the competitiveness: 30<64,5< 100.

Component optimization for sustainable development – "ecological activity and social factor" was con-

ducted due to the implementation of the program of ecologically oriented airport control and measures for lowering of the harmful environmental effects.

Conclusions. After implementation of additional measures for environmental safety for sustainable development, vector motion to the perspective of competitiveness rise of the NKMZ became the result of technique approbation. Point N (70,2; 62,1; 75,1) and point N' (72,5; 64,9; 65,8) define the position of machine-building enterprise NKMZ (Fig. 1) before and after optimization ecological and social measures of sustainable development accordingly. This indicates the rise of its general competitiveness.

After implementation of the program of sustainable development on NKMZ it is noted the rise of the following levels and there is an opportunity to control the general competitiveness of the enterprise due to the control measures according to sociality-ecological component ("E"). Introduced approach for "competitive space" formation (parameters of competitiveness of enterprise, its innovative and sociality-ecological component were chosen as the main control parameters) gives the opportunity to provide effectiveness of strategy of sustainable development on the machine-building enterprise in competitive environment.

After formation of competitive space (Fig. 1) there is a possibility to estimate enterprise position towards the limits of its competitive space, gaps defining according to the specified characteristic, perspective defining for movement control (along the vector of one key space component – "ecological activity") to perspective of general competitiveness rise of the enterprise.

Advantage of the model is in its versatility and flexibility. It enables to use it for enterprises under any conditions of their development and state of environment. Perspectives for further research are in the preparation of optimal strategy model for sustainable development of the enterprise.

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Латишева О. В. Екологічна складова потенціалу сталого розвитку машинобудівних підприємств як інструмент управління конкурентоспроможністю

У статті досліджено процес еколого-економічного управління "конкурентним простором" машинобудівних підприємств з урахуванням фактору екологічної активності, економічної складової конкурентоспроможності та інноваційного чинника, управління якими дозволяє підвищити загальну конкурентоспроможність та сталість підприємств. У представленій моделі було вибрано параметри оцінки конкурентоспроможності продукції машинобудівних підприємств, інноваційної і екологічної активності, що дозволяє усебічно оцінити ефективність їх функціонування в конкурентному середовищі й визначити напрями сталого розвитку машинобудівної галузі.

Ключові слова: сталий розвиток, еколого-економічне управління, машинобудівні підприємства, конкурентне середовище, моделі "конкурентного простору", інноваційна активність, екологічна складова.

Латышева Е. В. Экологическая составляющая потенциала устойчивого развития машиностроительных предприятий как инструмент управления конкурентоспособностью

В статье исследован процесс эколого-экономического управления "конкурентным пространством" машиностроительных предприятий с учетом фактора экологической активности, экономической составляющей конкурентоспособности и инновационного фактора, управление которыми позволяет повысить общую конкурентоспособность и устойчивость предприятий. В представленной модели были выбраны параметры оценки конкурентоспособности продукции машиностроительных предприятий, инновационной и экологической активности, что позволяет всесторонне оценить эффективность их функционирования в конкурентной среде и определить направления устойчивого развития машиностроительной отрасли.

Ключевые слова: устойчивое развитие, эколого-экономическое управление, машиностроительные предприятия, конкурентная среда, модели "конкурентного пространства", инновационная активность, экологическая составляющая.

Latysheva Ye. The ecological component of potential of sustainable development of machine-building enterprises as a management instrument by a competitiveness

The process of ecologically - economic management of "competitive space" of machine-building enterprises are investigated in the article. Ecological activity, economical component of competitiveness and innovative factors are accepted in models for the increase of total competitiveness of enterprise. Their control makes it possible to increase the competitiveness and sustainability of machine-building enterprises. The parameters of competitiveness estimation of products of machine-building enterprises, innovative and ecological activity were chosen in the presented model. This enables to estimate efficiency of enterprises functioning in competitive environment in details and define directions of strategic development of machine-building industry.

Keywords: sustainable development, ecologically-economic management, machine-building enterprises, competitive space, models of "competition space", innovative activity, ecological component.