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## "COMPETITIVE SPACE" MODEL FORMATION WITHIN AIRCRAFT INDUSTRY

***The paper explores a competitive space model for aircraft enterprises with regard to ecological and innovative factors that increase the aircraft industry competitiveness. The above model offers a competitiveness parameters estimation for aviation services of aircraft enterprises, as well as innovative and environmental activity that enables an overall assessment of the efficiency of enterprises functioning in competitive environment and identifies the directions of strategic development of the aircraft industry.***

***Keywords:*** *competitive environment; competitive space model; innovative activity; ecological factor; aircraft industry.*

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## ФОРМУВАННЯ МОДЕЛІ «КОНКУРЕНТНОГО ПРОСТОРУ» АВІАЦІЙНОЇ ГАЛУЗІ

***У статті досліджено процес формування моделі «конкурентного простору» підприємств авіаційної галузі з урахуванням екологічного та інноваційного чинників, управління якими дозволяє підвищити конкурентоспроможність авіаційної галузі. У представленій моделі обрано параметри оцінювання конкурентоспроможності авіаційних послуг підприємств авіаційної галузі, інноваційної й екологічної активності, що дозволяє всебічно оцінювати ефективність їх функціонування в конкурентному середовищі і визначати напрями стратегічного розвитку авіаційної галузі.***

***Ключові слова:*** *конкурентне середовище; модель «конкурентного простору»; інноваційна активність; екологічний чинник; авіаційна галузь.*

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## ФОРМИРОВАНИЕ МОДЕЛИ «КОНКУРЕНТНОГО ПРОСТРАНСТВА» АВИАЦИОННОЙ ОТРАСЛИ

***В статье исследован процесс формирования модели «конкурентного пространства» предприятий авиационной отрасли с учетом экологического и инновационного факторов, управление которыми позволяет повысить конкурентоспособность авиационной отрасли. В представленной модели выбраны параметры оценки конкурентоспособности авиационных услуг предприятий авиационной отрасли, инновационной и экологической активности, что позволяет всесторонне оценивать эффективность их функционирования в конкурентной среде и определять направления стратегического развития авиационной отрасли.***

***Ключевые слова:*** *конкурентная среда; модели «конкурентного пространства»; инновационная активность; экологический фактор; авиационная отрасль.*

**Introduction.** Aircraft industry activity (of airports in particular) might have a harmful effect on the environment by various factors, namely: emissions into the atmosphere, water and land pollution, noise pollution etc. Under the conditions of European integration of Ukraine and arrangement of strict ecological requirements for aircraft companies the problem of ecological indicators improvement is of great importance. Imperfect functioning of airports in ecological problems solving cause the topicality of this research, namely the formation of the model of ecologically oriented development of airports aimed at increasing their competitiveness.

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**Latest researches and publications analysis.** Ecological problems of aircraft enterprises and issues of airports security have been researched by such scientists as O.M. Andronov and N.P. Sevastianov (1989), O. Zaporozhets and K. Sinilo (2005), Y.F. Kulaev and V.I. Shchelkunov (2010), N.J. Polyanska (2004), Z.P. Rumyantseva (1987) and others. The algorithm of economic systems modelling has been studied by the following foreign and Ukrainian scientists: M.V. Gracheva et al. (2005), S.A. Minyk et al. (2002), V.V. Rosen (2002), B.J. Sovetov and S.A. Yakovlev (2001) and others.

The algorithm of "competitive space" modelling for industrial enterprises to control production expenses is demonstrated in the works of Y.F. Kalinina (2007) and A.S. Kuznetsova (2007). The model of competitive price space formation for international business entity is presented in (Ilyenko, 2013). However, the problem of competitiveness control modelling for aircraft enterprises with regard to the ecological factors needs to be resolved.

**The purpose of the article** is constructing a model for parameters control of aviation competitiveness with an emphasis on ecological component of aircraft enterprises activity.

**Key research findings.** Aircraft enterprises have to consider global processes in economic space. Under such conditions an increase of enterprise competitiveness on the basis of ecological marketing and innovative development is critical. Special attention should be paid to its determination within general competitive environment. The use of economic and mathematical instruments for competitive profile presentation of enterprise as a three-dimensional space would be chosen as the best area for competitive environment modelling for an aircraft enterprise.

Russian researchers Y.F. Kalinina (2007) and A.S. Kuznetsova (2007) used this technique for expenses control of an "ideal" product. They used a limited number of indicators for goods as well (only specialists of the enterprise took part in the infobase formation without accounting customers' opinions and their attitude to goods).

From the mathematical perspective a three-dimension space (Figyre 1) is presented in the form of a pyramid (Gracheva et al., 2005; Itzkov, 2009; Minyk et al., 2002; Pickover, 1999; Rosen, 2002; Rucker, 1984; Sovetov and S.A. Yakovlev, 2001).

A "three-dimension space" is formed by: parallel to the plane *YZ* (plane *ABD*), parallel to the plane *YX* (plane *BCD*), parallel to the plane *ZX* (plane *ABC*), plane placed angularly (plane *ACD*). Their extremities coordinates are: $A\ (Z_{max},\ X_{min},\ Y_{max})$, $B\ (Z_{min},\ X_{min},\ Y_{max})$, $C\ (Z_{min},\ X_{max},\ Y_{max})$, $D\ (Z_{min},\ X_{min},\ Y_{min})$.

"Three-dimension space" (Figure 1) parameters may be changed in 3 directions (rise, fall and be invariable) and compose 27 combinations. It is unreasonable to consider the first 8 combinations (they don't provide three-dimension space hit and are out-of-space). The last 19 options are reasonable to consider (they provide three-dimension space hit and are within).

On the basis of this mathematical approach (Figure 1) it is suggested to make the model of competitive environment for an aircraft enterprise.

The parameters of "competitive space" are defined within the enterprise: *Y axis* – competitiveness (*K*) of air transport enterprise services – the 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 enter-

prise – stage (ability and readiness) and effectiveness of new technologies implementation into economic activity; *X axis* – ecological activity (*E*) of the enterprise – stage (ability and readiness) and effectiveness of ecological programs development and realization at the enterprise according to present requirements of ecological safety.

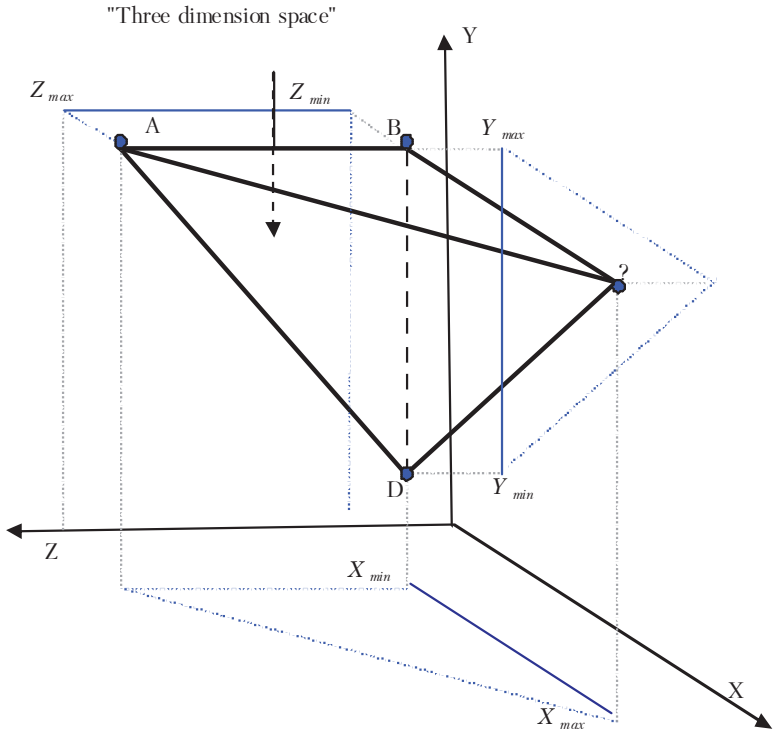


*Figure 1.* **Mathematical model of the three dimension space** (Rosen, 2002: 196; Sovetov and S.A. Yakovlev, 2001: 140–143)

When estimating these parameters it is necessary to carry out a full-fledged analysis of all the components on the basis of expertise. Positioning process of air transport 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 aircraft 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, there is a need to carry out the analysis of external and internal environment, elicit "gaps" in the activity and define the directions for further development. If the enterprise moves to the "perspective of competitiveness rise" area, space parameters move towards the optimal level of enterprise competitiveness.

Maximum and minimum parameters for competitive space were defined by the experts in order to assess the international airport "Kyiv" (considering the best and the worse estimation of corresponding parameters of the competitors at the market):

$I_{max}$ is defined at 50-point level, $I_{min}$ is 12.5, $E_{max}$ is 50, $E_{min}$ is 5, $K_{max}$ is 100, and $K_{min}$ is 30.

Equation for every plane passing through 3 points:

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

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

$$f(I;E;K)=(17.5-50)\times(50-5)\times(30-100)-(64.5-100)\times(50-5)\times (50-12.5)-(22.5-5)\times(50-12.5)\times(30-100)=f(17.5;22.5;64.5).$$

The check up proves that the airport "Kyiv" is within "competitive space" (Figure 2), because the following conditions are complied:

- according to the parameters of innovative activity: 12.5 < 17.5 < 50;
- according to the parameters of ecological activity: 5 < 22.5 < 50;
- according to services competitiveness: 30 < 64.5 < 100.

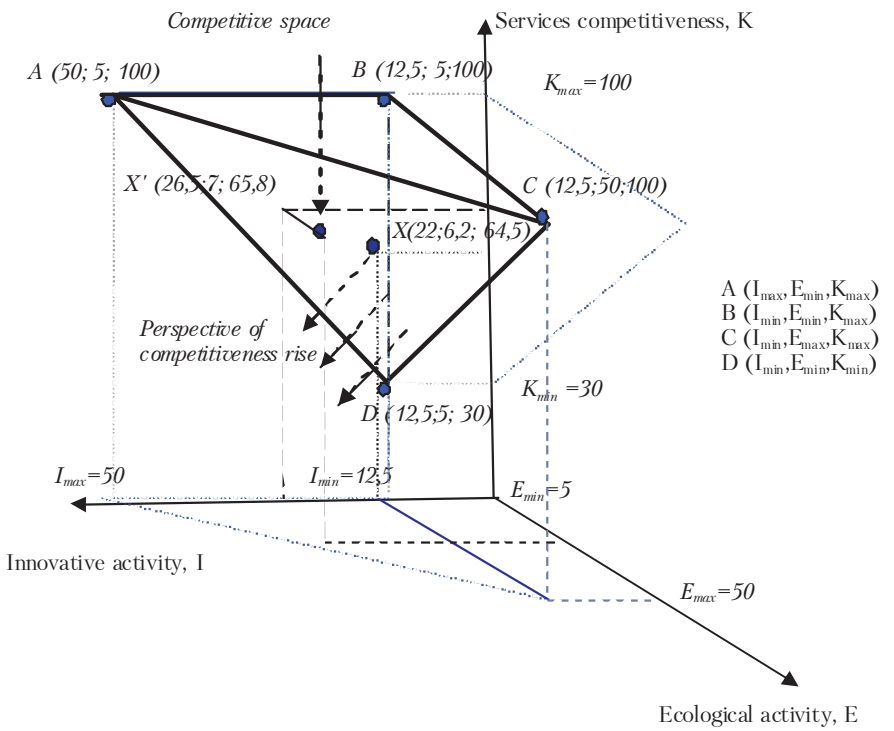


*Figure 2.* **Change of aircraft enterprise position towards the perspective of competitiveness rise,** *developed by the author*

Component optimization – "ecological activity" was conducted due to the implementation of the program of ecologically oriented airport control and measures for lowering harmful environmental effects.

After the implementation of additional measures for environmental safety, vector motion to the perspective of competitiveness rise of the airport became the result of technique approbation.

Point $X$ (22; 6.2; 64.5) and point $X'$ (26.5; 7; 65.8) define the position of aircraft enterprise (airport "Kyiv") before and after optimization ecological measures accordingly.

This indicates the rise of its general competitiveness. After the implementation of the program of ecologically oriented development control of the airport "Kyiv" the rise of the following levels is noted: according to the "ecological activity" component by $\Delta E_{X-X'} = 11.43\%$, according to the "innovative activity" component by $\Delta I_{X-X'} = 16.98\%$, according to the services competitiveness by $\Delta K_{X-X'} = 4.87\%$.

**Conclusions.** So, there is an opportunity to control the general competitiveness of the enterprise by the control measures according to one component ("ecological activity"). The introduced approach to "competitive space" formation (parameters of services competitiveness of aircraft enterprise, its innovative and ecological activity were chosen as the main control parameters) gives the opportunity to provide effectiveness of the aircraft enterprise within the competitive environment.

After the formation of competitive space (Figure 2) there is a possibility to estimate an enterprise position towards the limits of its competitive space, gaps defining according to the specified characteristic, perspective identification of the movement control (along the vector of one key space component – "ecological activity") to perspective of general competitiveness rise of the enterprise.

The advantage of this model is in its versatility and flexibility. It can be used for the enterprises under any conditions of their development and state of environment.

Perspectives for further research are the development of optimal strategy model for ecologically oriented enterprise development.

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