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METHODOLOGICAL PRINCIPLES OF AIRPORT VALUE-BASED RESTRUCTURING MANAGEMENT IN A VOLATILE ECONOMIC ENVIRONMENT

It was offered the methodical approach to flexible budgeting of restructuring and development processes, which is based on the growth model of own working capital, growth rate of net income, which has to outrun the growth rate of total assets. On the basis of suggested approach, there were defined the limits of allowable deviation of success indicators of airports restructuring from target values. To provide the continuous flow of end-to-end business process and preserve competitiveness of their products in the local and global markets, there was developed information and methodological maintenance of airport value-based restructuring management in a volatile economic environment.

Key words: *value-based restructuring, net working capital, total assets turnover, financial resource demand elasticity, fuzzy numbers.*
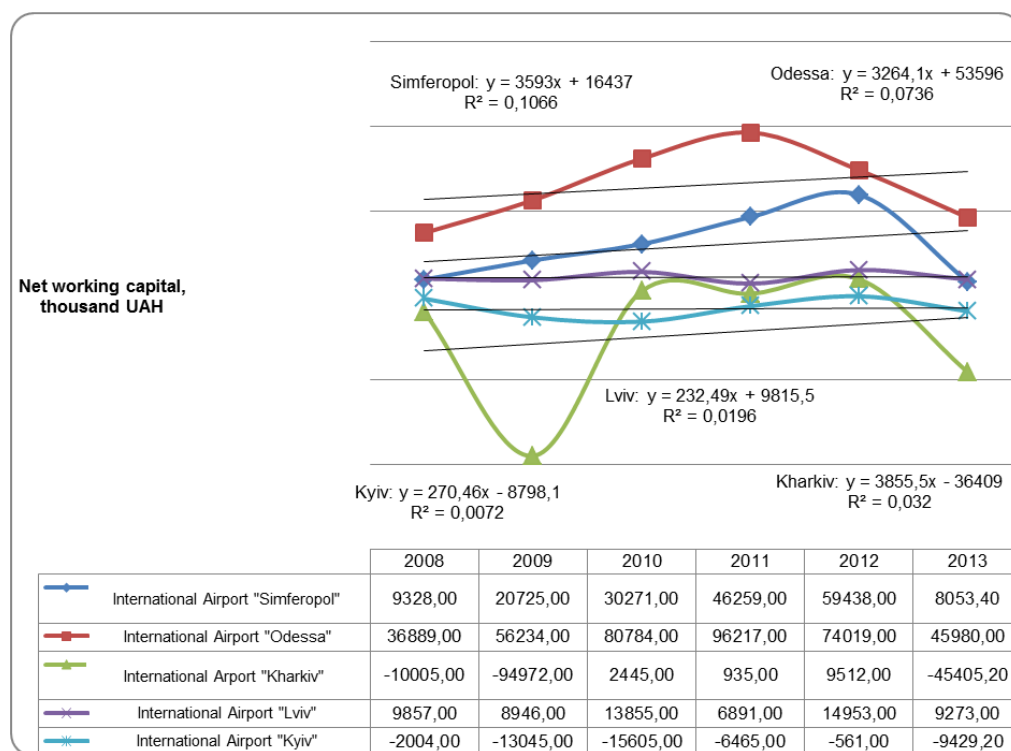
Problem statement. *The aim of enterprise restructuring is to ensure its further development, and also ability to adapt flexibly to changing conditions of external environment. Adaptability of enterprises to changing conditions of external environment is determined directly by its financial resource capacity, lack of which makes the continuous flow of end-to-end business process impossible and eliminates the possibility to preserve competitiveness of its products in the local and global markets. The above mentioned is also fully valid for such large-scale business systems, as international airports.*

Publications analysis. *The problem of airports financial flows management still hasn't been studied deeply enough in the works of native scientists. The articles [4,5,8] unveil only certain aspects of the improvement of the effectiveness of air traffic services. In return, scientists offered a lot of successful solutions, which were intended to improve the financial restructuring efficiency of enterprises of other types of activities, in particular [1—3,6,7,12].*
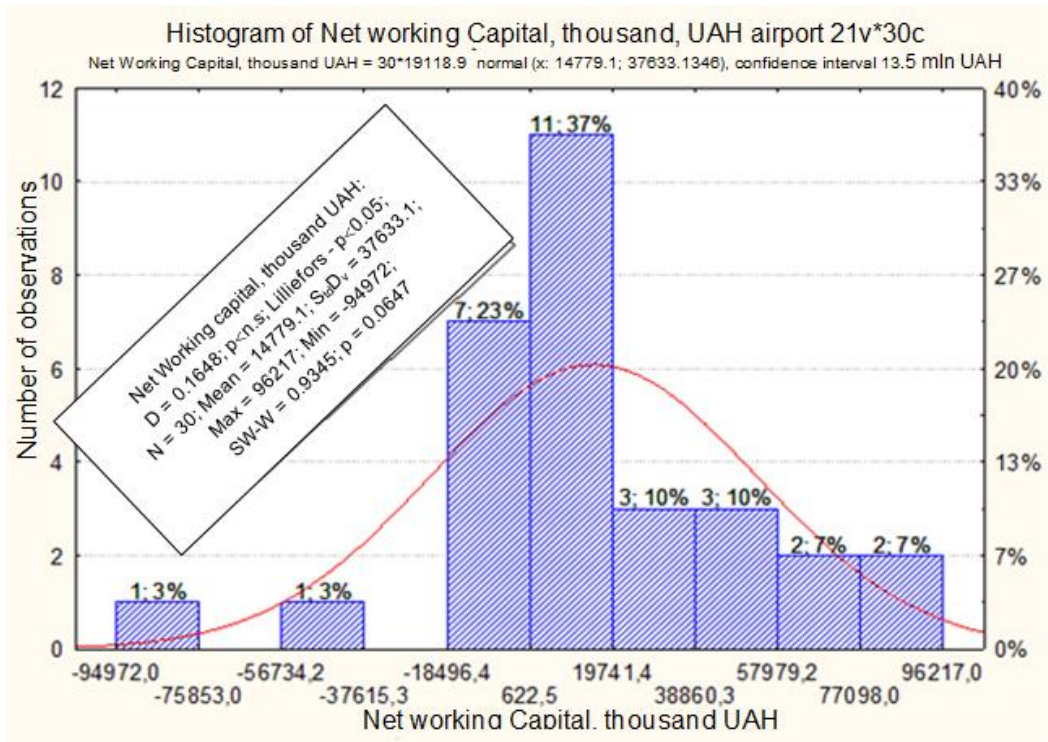
Object of an article. *Development of information and methodological maintenance of airport value-based restructuring management in a volatile economic environment with the aim to provide the continuous flow of end-to-end business process and to preserve competitiveness of their products in the local and global markets.*

Key research findings. *Taking into account the specific nature of airports activity, which is represented by the extensive network of external economic relations and their constant dynamics; by the system of numerous external and internal factors, which affect quality and timeliness of service supply, a key place must be taken by a self-identification type of restructuring during the process of managerial decisions making. Self-identification of the enterprise and definition of its own mission are considered to be its strategic task, role, which defines the essence of existence, however a bankrupt enterprise is not able to achieve its mission, therefore, the financial indicator of the enterprise's ability to carry out its mission is a positive value of a net working capital indicator. After all, ability of a business entity to carry out accrued current financial liabilities is a decisive indicator of the ability and expediency of conducting basic operating activity. Thus, the success of airport value-based restructuring management in a volatile economic environment has to be characterized by positive values and growth of the airports' existing net working capital (NWC), which enables to distinguish between their current assets and current liabilities, to investigate their ability of covering current liabilities and business expansion.*

Analysis of changes of net working capital indicator according to the set of airports studied during the period from 2008 till 2013 (Fig.1a), indicates the presence of positive tendencies in the possibility of current liabilities repayment and the availability of means for improvement, development of current activity. 80% of studied airports show a steady tendency to growth of net working capital, reaching the maximum value in 2012. It should be noted that International Airport "Kyiv", which had a negative value of this indicator during the studied period, also showed a tendency to its maximization. However, as shown in Fig.1a, there was no constant linear tendency of airport's accrued net working capital growth — following the results of 2013 year, each and all airports, showed a rapid decline of working capital.

Simferopol: $y = 3593x + 16437$
$R^2 = 0{,}1066$

Odessa: $y = 3264{,}1x + 53596$
$R^2 = 0{,}0736$

Net working capital,
thousand UAH

Lviv: $y = 232{,}49x + 9815{,}5$
$R^2 = 0{,}0196$

Kyiv: $y = 270{,}46x - 8798{,}1$
$R^2 = 0{,}0072$

Kharkiv: $y = 3855{,}5x - 36409$
$R^2 = 0{,}032$

	2008	2009	2010	2011	2012	2013
International Airport "Simferopol"	9328,00	20725,00	30271,00	46259,00	59438,00	8053,40
International Airport "Odessa"	36889,00	56234,00	80784,00	96217,00	74019,00	45980,00
International Arport "Kharkiv"	-10005,00	-94972,00	2445,00	935,00	9512,00	-45405,20
International Airport "Lviv"	9857,00	8946,00	13855,00	6891,00	14953,00	9273,00
International Airport "Kyiv"	-2004,00	-13045,00	-15605,00	-6465,00	-561,00	-9429,20

a)

Histogram of Net working Capital, thousand, UAH airport 21v*30c

Net Working Capital, thousand UAH = 30*19118.9 normal (x: 14779.1; 37633.1346), confidence interval 13.5 mln UAH

b)*Fig. 1. Changes in NWC of international airports in 2008 — 2013:
a) trend analysis in the context of individual objects;
б) statistic characteristic of a sample of observations
*(calculated by author according to the data **[13]**)*

Trend equations which are given in Fig. 1a are unable to approximate properly tendencies of airports adaptation to permanent changes of economic environment. Hence, it follows that, firstly, national airports require image restructuring, secondly, strategic change management requires the latest methodological support of decision making and control of its execution.

Statistical characteristics of the sample of observations f airports functioning are systematized in Fig.1b, which shows that on average, airports are able to accumulate 14,8 million UAH of net working capital — such amount of working capital is observed in 37% of all cases. Sample is characterized by a significant standard deviation— 37,6 mln.UAH., that's why, 95% confidence band of mean values is equal to 13,5 mln.UAH.

Inability to control business processes of airports based on the existing forecasting methods, primarily on the basis of trend analysis, is explained by the fact that identification of airports' net working capital requirements in a volatile economic environment is related to a number of uncertainties, namely: under conditions of systematic drop in real income of a country, permanent political crises, extremely ineffective foreign economic policy, air passenger volume and air cargo traffic decline steadily, as the ability of airlines to discharge their financial obligations from airport charges in time and to the full extent. The same concerns a matter of income from rentals, advertising and other activities, which constitute airports' earnings. In return, the necessity of proper level of air transportation safety

provision requires considerable investments and current expenditures to maintain airports' infrastructure in working condition.

The financial issue of restructuring concerns the application of various methods and instruments in order to increase efficiency of financial resources utilization and formation [6]. Quantitative changes are achieved through redemption of debts or their relief (conclusion of settlement agreement) and, vice versa, through obtaining of additional financial resources as a loan [1]. Absolutely admitting statements in [1], consider it appropriate to emphasize the following features of the airports' financial flows formation, which will affect significantly the effectiveness of all measures taken the during restructuring self-identification.

Thus, the following factors influence the changes of studied airports' net working capital [14, c. 77]:

❀ *Increase of operating profitability through positive shift of earnings-growth rate over the growth rate of prime cost of air transport services;*

❀ *Since almost all studied airports are objects of state ownership, which are not subjects to privatization [10], the short-term replenishment of their equity is hardly probable. Expansion of airports' capital stock is considered to be of low probability due to chronic state budget deficit during 2004 – 2014 years;*

❀ *According to the current legislation, stock companies, a main majority stakeholder of which is a state, are obliged to pay dividends of 30% of net profit [11], which inevitably leads to an increase of liabilities and reduction of working capital;*

❀ *Ensuring positive business reputation of airports requires appropriate financial discipline of those airports, particularly regarding compliance with the schedule of debt obligations repayment and service — this, usually, reduces the amount of airports' working capital;*

❀ *In accordance with eurointegration vector of Ukraine's foreign policy, the growth of air transportation security and comfort requirements demands from airports systematic expenses for updating and maintaining of fixed assets in working condition. In addition, considerable costs of airports are caused by the utilization of intangible assets, which are essential for innovation and technological development of infrastructure. At the same time, non-current assets sale is a relatively small source of airports' income. All of the aforesaid leads to the excess of amount of used working capital over the size of its sources.*

As the efficiency of all types of restructuring, which may occur in order to stabilize airports long-term development, is reflected in the changes of net working capital, the management process of structural changes envisages, firstly, justification of target indicators of current assets and estimated current liabilities, secondly, — control of their achievement.

In order to ensure financial stabilization, a statistical method for determining target indicator of current liabilities was offered in the article [2] that will enable any enterprise both to keep a positive business reputation and improve its financial resource capacity. This method is based on the interdependence of the enterprise financial requirements on the changes of its net income, and which is suggested to be defined by the value of a certain elasticity coefficient. In our opinion, such approach can be used for management of the effectiveness of airports self-identification restructuring. In this regard, firstly, it is necessary not to focus solely on the dynamics of the estimated current liabilities, but to choose target value of net working capital or its change during the planed period as an efficiency indicator. Secondly, elasticity of airports' working capital requirements in terms of net income, does not completely display the peculiarities of business cycle of transport companies — the business

activity of airports is far better determined by the dynamics, i.e. growth rate of total assets turnover (T_{AUR}). Thirdly, it should be noted that recommendations of Ukrainian and foreign scholars concerning the use of flexible budgeting as a tool for improvement of financial management of enterprise. Flexible budget is used to analyze reasons which caused unfavorable deviation from static budget that is why this tool of financial management is worth special attention in terms of improvement of restructuring processes management of airports operating under current conditions. Flexible budget — is a budget which is prepared not for a certain level of business activity, but for its specific range. The flexible budget considers changes in expenses and, accordingly, financial resource requirements depending on implementation level changes. In our opinion, flexible budgeting methodology should be applied not only on the stages of financial controlling of sales of goods, as it is suggested in [9, p. 457], but also while planning financial assurance of restructuring processes and identification of expected results of value-based restructuring.

In view of the aforesaid, the following formula to determine the target indicator of airport net working capital was offered:

$$NWC = NWC_0 \bullet (1 + E_{AUR} \bullet T_{AUR}), \tag{1}$$

where **NWC** *and* **NWC₀** *— target and base values of airports net working capital;*

T_{AUR} *— planned annual increment of airport business activity, expressed in percentage of total assets turnover increase;*

E_{AUR} *— elasticity of airports' working capital requirements depending on the level of business activity, which can be determined by averaging out a ratio of net working capital increment rate ($\Delta\% NWC$) and total assets turnover ($\Delta\% AUR$) for the last 3—5 years:*

$$E_{AUR} = \frac{\sum_{t=1}^{5(3)} \dfrac{1 + \Delta\% NWC_t}{1 + \Delta\% AUR_t}}{5(3)}, \tag{1a}$$

where t — serial number of year of a retrospective period.

*In order to improve flexible budgeting in the conditions of macroeconomic instability it is considered to be reasonable to use innovative scientific tool — fuzzy mathematics. In fact, a particular value range of financial and economic indicator of any enterprise, where restructuring activities are carried out, including the airport, can be achieved with a varying degree of confidence. Fuzzy number — is a normally convex fuzzy set (denoted as **A**), with a piecewise continuous membership function, given on a set of real numbers. Within the framework of flexible budgeting we consider it expedient to express in the form of fuzzy numbers all four economic indicators, which are available in the formula (1) — target and base values of NWC, elasticity of working capital requirements depending on the level of airport business activity, and also planned indicator of dynamics of business activity.*

In our opinion, representation of economic indicators or parameters of restructuring by means of fuzzy numbers should take into account statistical characteristics of relative indicators of existing enterprises. Therefore, aiming to improve airport value-based restructuring management it is considered to be appropriate to apply Gaussian membership function, which is given by the formula:

$$\mu(\tilde{A}) = exp\left(-\frac{1}{2} \cdot \left(\frac{u-m}{\sigma}\right)^2\right), \qquad\qquad (2)$$

where $\mu(\tilde{A})$ — the degree of **u**-element fuzzy set $\tilde{A}$ membership. Element **u** — is a crisp number, that is possible value of a particular economic indicator, and the entire range of values of **u** is called the universal set;

m — maximum coordinate of membership function, or mean value, or mode of fuzzy number (modal value),

σ — concentration ratio, which equals to mean-square deviation of a variable, or fuzziness coefficient.

It is not necessary that chart of fuzzy numbers should be "symmetric" curvilinear figure. In other words, left and right sections of the chart may have different curvature. Analytically such a piecewise-curvilinear relationship can be set as a combination of two Gaussian functions with different values of fuzziness coefficienti: σ_1 and σ_2. To reduce calculations fuzzy number can be represented by three parameters $\tilde{A} = (m, \sigma_1, \sigma_2)$. Such fuzzy number is also called L—R number since left and right branches of chart have different configuration. As a result of arithmetic operations with fuzzy numbers, which are actually called "soft computing", new fuzzy numbers can be determined given as membership functions, which are obtained as a result of arithmetic operations with parameters of membership functions of initial fuzzy numbers.

In accordance with the concept of flexible budgeting all arguments and and results of the formula (1) can be expressed by fuzzy numbers. That is, arguments of the formula (1) must be defined by means of the Gaussian membership function (2), parameters m and σ of which should be determined on the basis of in-depth study of statistical characteristics of working capital and business activity of studied airports. In return, membership function of productive indicator— target value of airport's NWC must be defined by means of arithmetic operations with fuzzy numbers-arguments of the formula (1). According to the formula (1) addition and multiplication operations should be performed with fuzzy numbers using formulas:

⊔ **Addition:**
$$\tilde{A} \oplus \tilde{B} \cong \left(m_a + m_b, \sigma_1^a + \sigma_1^b, \sigma_2^a + \sigma_2^b\right)_{LR}, \qquad\qquad (3)$$

⊔ **Multiplication:**
$$\tilde{A} \otimes \tilde{B} \cong \left(m_a \bullet m_b, \; m_a \bullet \sigma_1^b + m_b \bullet \sigma_1^a, \; m_a \bullet \sigma_2^b + m_b \bullet \sigma_2^a\right)_{LR}, \; if \; m_a > 0, \; m_b > 0 \; (4a)$$
;
$$\tilde{A} \otimes \tilde{B} \cong \left(m_a \bullet m_b, \; m_b \bullet \sigma_1^a - m_a \bullet \sigma_2^b, \; m_b \bullet \sigma_2^a - m_a \bullet \sigma_1^b\right)_{RL}, \; if \; m_a < 0, \; m_b > 0 \; (4b)$$
;
$$\tilde{A} \otimes \tilde{B} \cong \left(m_a \bullet m_b, \; -m_a \bullet \sigma_2^b - m_b \bullet \sigma_2^a, \; -m_a \bullet \sigma_1^b - m_b \bullet \sigma_1^a\right)_{RL}, \; if \; m_a < 0, \; m_b \; (4c)$$

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In each specific case of airport restructuring management, a fuzzy number which is used to describe a basis value of net working capital can be determined on the basis of expert opinion. However, by taking into account the above established general tendency to reduction of airports working capital in 2013, which continued in 2014, we consider it appropriate to substantiate reference range of values of net working capital, which should be the basis for the system of restructuring measures efficiency controlling. On the basis of average value of net working capital (NWC) and its confidential interval for the studied sample (fig. 1, b) the

appropriate fuzzy number $\widetilde{NWC}_0 = \langle 4,8;13,5;13,5 \rangle$ *was defined. To justify the parameters m and* σ *of fuzzy numbers aimed to identify the elasticity of working capital requirements in terms of business activity and its possible changes during the planned period, we proceeded from the assumption about accelerated growth of financing requirements, compared to the total assets turnover, which is natural in the condition of financial resources total deficit in all sectors of economy. Such assumption doesn't contradict scientists' recommendations concerning optimal financial managements of enterprises development, in particular modification of «golden proportion» of economic growth assumes the excess of own capital growth rate over net income growth rate, which must outpace the growth rate of total assets.*

In order to study quantitative features of airports' need in working capital depending on dynamics of their business activity, we have performed k-means cluster analysis of such indicators (table 1):

1. Elasticity of NWC requirements in terms of return on total assets;

2. The growth of total capital turnover.

Proceeding from the assumption about rapid growth in working capital requirements compared to the increase of current assets turnover of those airports, which successfully implement the program of economic activity restructuring, parameters of fuzzy numbers $\widetilde{E}_{AUR}$ *ma* $\widetilde{T}_{AUR}$ *were determined based on descriptive clusters statistics with maximum average values of relevant indicators (in the table1 they are __highlighted in bold and underlined__).*

Thus the parameters of fuzzy numbers — arguments of formula (1) are the following:

❋ ***Elasticity of working capital requirements in terms of level airport's total assets turnover*** $\widetilde{E}_{AUR} = \langle 7,6;2,4;2,4 \rangle$. *In other words, each percent of increment of airports' working capital turnover requires NWC increase at 7,6%± 2,4%. If we had taken into consideration indicators in table1, relevant to «average» or «low» cluster, during calculation of NWC requirements under the concept of flexible budgeting, such interval of elasticity indicator wouldn't have reflected the "capital intensity" of airport's business activity growth to the full extent;*

❋ ***Planned indicator of airport's business activity dynamics*** $\widetilde{T}_{AUR} = \langle 1;0,38;0,38 \rangle$, *which allows to perform qualitative assessment of the effectiveness of airports' marketing restructuring. After all, airports' products and services management in accordance with market conditions must be reflected quantitatively by the growth of existing airport's*

property turnover coefficient at least by $2 \pm 0,38$ % annually. In this regard it should be noted that the State Enterprise "International airport" Lviv ", which was recognized as the best airport in CIS according to the results of 2013, completely complied with the proposed criteria in 2012 and 2013.

Table 1

Results of cluster analysis of quantitative characteristics of airports' needs in working capital
(calculated by author according to the data [13])

Cluster	Average value	Standard deviation	Кількість спостережень
Variable «**Increase in total assets turnover**»: *unit of measurement — percentage points* Intercluster dispersion: 5,89; Intracluster dispersion: 2,52; F-criterion: 44,42; Number of degrees of freedom: 24, p-level 0,000002			
1	*2*	*3*	*4*
Maximal	*2,02*	*0,38*	*10*
1	*2*	*3*	*4*
Average	0,91	0,22	13
Minimal	0,17	0,14	3
Variable «**Elasticity of airports' needs in working capital in terms of business activity level**»: *unit of measurement— non-dimensional value* Intercluster dispersion: 313,71; intracluster dispersion: 77,78; F-criterion: 36,3; Number of degrees of freedom: 24, p-level 0,000000			
Maximal	*7,61*	*2,41*	*10*
Average	0,97	1,13	7
Minimal	—2,26	2,42	9

In accordance with the formula (1) and based on the dependence (4a) «flexibility» of net working capital increase, which necessarily arises in case of effective management of marketing restructuring, can be defined by the following fuzzy number:

$$\tilde{E}_{AUR} \bullet \tilde{T}_{AUR} = (7,6 \bullet 2; 7,6 \bullet 0,38 + 2 \bullet 2,4; 7,6 \bullet 0,38 + 2 \bullet 2,4) = (15,2; 7,7; 7,7)$$

It means, that in order to meet the needs of airport in financial resources, annual net working capital growth must be at least $15,2 \pm 7,7$% during the period of restructuring measures implementation, provided that it does not exceeds1 year.

If the target indicator of airport net working capital requirements is justified in accordance with our recommendations concerning flexible standard of net working capital

($\tilde{NWC}_0 = (4,8; 13,5; 13,5)$), then the success of self-identification restructuring has to ensure the growth of airport net working capital by $2,25 \pm 3,2$ mln. UAH at the end of the period of its execution, since according to (4a):

$$\tilde{\Delta}_{NWC} = \tilde{NWC}_0 \cdot \tilde{E}_{AUR} \cdot \tilde{T}_{AUR} = (0{,}152 \cdot 14{,}8; 0{,}152 \cdot 13{,}5 + 14{,}8 \cdot 0{,}77; 0{,}152 \cdot 14{,}8; 0{,}152 \cdot 13{,}5 + 14{,}8 \cdot 0{,}77)$$

$$\Downarrow$$

$$\tilde{\Delta}_{NWK} = \tilde{NWC}_0 \cdot \tilde{E}_{AUR} \cdot \tilde{T}_{AUR} = (2{,}25; 3{,}2; 3{,}2)$$

That is self-identification restructuring of an airport can be considered effective, if upon completion of all actions provided by this restructuring, the airport's working capital will be not less than 17,5 ± 16,7 mln.UAH, since according to (3):

$$\tilde{NWC}_u = \tilde{NWC}_0 + \tilde{\Delta}_{NWC} = (14{,}8 + 2{,}25; 13{,}5 + 3{,}2; 13{,}5 + 3{,}2) \Rightarrow \tilde{NWC}_u = (17{,}1; 16{,}7; 16{,}7)$$

However, such range is rather wide, therefore in order to justify the permissible limits of volatility interval of net working capital, falling within which gives reasons to assert about the efficiency of airports restructuring, it should be limited by the range of universal set which corresponds to alpha-cut of fuzzy number at level of 95%. On the basis of fuzzy number $\tilde{NWC}_u$ the lower limit of working capital that needs to be maintained under conditions of successful restructuring, is established based on the dependence:

$$\tilde{NWC}_u = exp\left(-\frac{1}{2} \cdot \left(\frac{NWC_u - 17{,}1}{16{,}7}\right)^2\right) = 0{,}95 \Rightarrow \underline{NWC_u} = 17{,}1 - 16{,}7 \cdot 0{,}32 = 17{,}1 - 5{,}4 \Rightarrow \underline{NWC_u} = 11{,}7 m \ln.UAH.$$

The corresponding graphical interpretation of fuzzy numbers and the results of computing the target indicator of airport net working capital according to the conception of flexible budgeting is shown in fig.2.
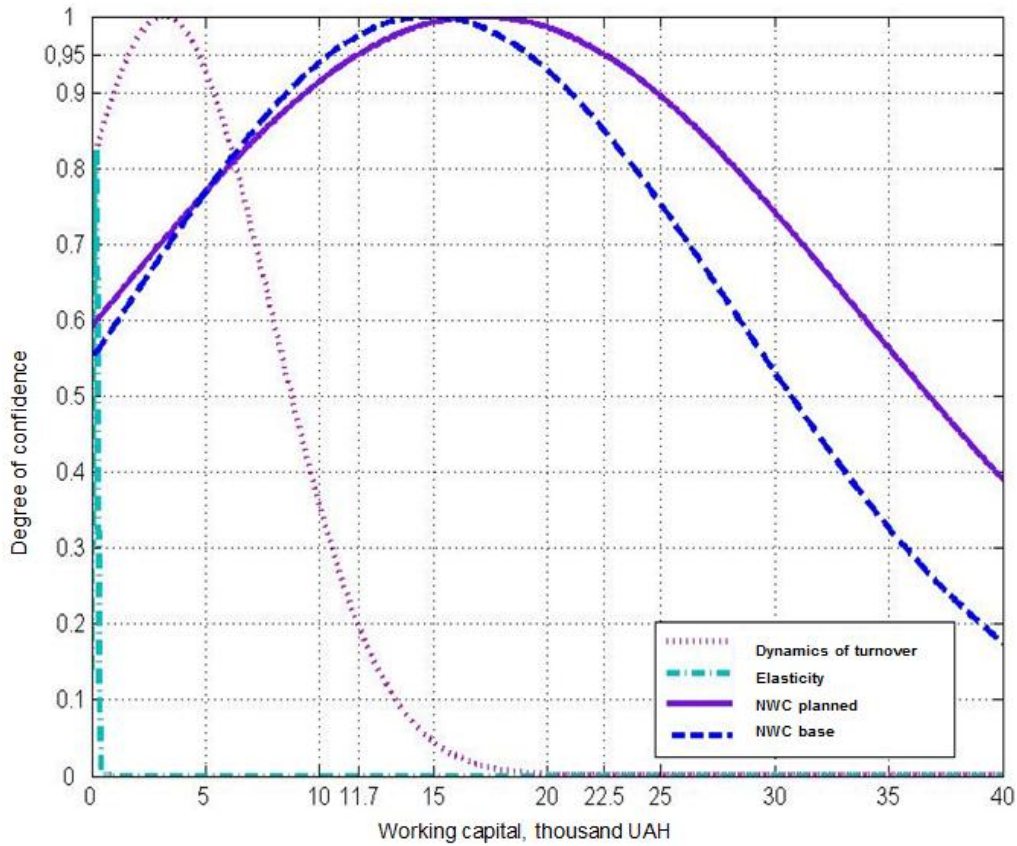
Fig.2. Graphical interpretation of fuzzy numbers — constituents of flexible budgeting of airport working capital (author's development)

     The concept of flexible budgeting and its realization by means of soft computing gives makes it possible to improve the process of control over the execution of complex of measures envisaged by restructuring strategies. Thus, restructuring can be considered successful if actual results correspond to planned one by 95% — precisely this α-cut is provided for automatic changes of membership function in most software applications that implement soft computing. In our opinion, reduction of the threshold of confidence to 90% or even 80% are quite acceptable taking into account unfavorable economic conditions of national and world economy. However, it is considered to be appropriate to accept 70% confidence level, as well as 75th quintile of statistical studies as lower limits for compliance of the achieved results with planned one. That is α-cut, which corresponds to 75% degree of confidence regarding the sufficient airport working capital, dynamics of return on assets or elasticity of its need in financial resources, makes it possible to establish clear boundaries of acceptable values of mentioned economic indicators of airports. Then, regardless of the taken characteristics of

fuzzy numbers $\tilde{E}_{AUR}$, $\tilde{T}_{AUR}$, $\widetilde{NWC}_0$ and $\widetilde{NWC}_{ц}$ in each particular case, we can assert about the satisfactory restructuring management if actual value of each of these parameters

deviates from modal one in either direction by not more than 0,75 standard deviations, since according to Gaussian membership function (2):

$$\mu(u) = exp\left(-\frac{1}{2}\cdot\left(\frac{u-m}{\sigma}\right)^2\right) = 0,75 \Rightarrow u = m \pm \sqrt{\frac{\ln 0,75}{-0,5}}\cdot\sigma \Rightarrow u \approx m \pm 0,75\cdot\sigma$$

*Similarly, **accepting 80% α-cut as a satisfactory level of airport financial restructuring management in a volatile economic environment, we will obtain a range of deviations of actual values of economic indicators from planned values within the limits of** $\pm 0,67\cdot\sigma$, that is 67% of these indicators standard deviation, which were defined based on historical data for the last 5 years. Finally, restructuring shall be recognized successful if the range of deviation of economic indicators actual values from basic one is limited by the interval $\pm 0,45\cdot\sigma$.*

Conclusions and prospects for further research. *The success of self-identification restructuring of airports is defined by dynamics of the available airports' working capital. Given the fact that measures, aimed at ensuring a capability of airports to economic growth, take place in the conditions of total deficit of financial resources in all sectors of economy, methodology of justification of airports' needs in working capital need to be improved, firstly, regarding the accounting of financial security elasticity from the planned growth level of business activity, secondly, dynamics of economic environment requires a flexible system of financial planning and controlling. In this article a methodological approach, which is able to meet both requirements was suggested, since informational support of flexible budgeting had been developed on the basis of in-depth statistical analysis of dynamic changes of the financial conditions and airports' business activity. Application of fuzzy arithmetic made it possible to determine criterion ranges for assessment of airports value-based restructuring management success. Prospects for further researches lie primarily in clarification of parameters of fuzzy numbers, chosen as performance indicators of self-identification and marketing restructuring, taking into account international standards of airports' activity efficiency.*

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