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FINANCIAL POTENTIAL ANALYSIS OF FORESTRY ENTERPRISES OF UKRAINE ON THE TAXONOMY METHOD BASIS

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Abstract:
In the article the method of analysis of financial potential using taxonomy method has been developed as well as it has been tested on the basis of empirical data of Ukrainian forestry enterprises. The application of such a method made it possible to construct a rating assessment of a complex and multifactorial economic object – the financial potential, using algorithms of systematization to multidimensional quantities. The authors present the stages of application of analytical procedures for assessing the dynamics of taxonomic indicators of financial potential as well as for constructing the rating of the suggested business entities. An innovative model of financial potential of forestry enterprises is proposed, which will allow to identify the complex of properties of an object as a basis for forming a set of analytical procedures for assessing its state. The obtained results of the analysis can serve as the basis for constructing a management strategy to optimize the financial potential of the enterprise.

Key words: *financial potential, forestry enterprises, matrix, rating estimation, taxonomy, taxonomic analysis method*

INTRODUCTION

Financial potential is a universal object of the business activity management of forestry enterprises, since it combines the economic efficiency of business activity, influenced by natural and climate as well as economic and legal factors. This leads to the formation of qualitative analytical support of managing the financial potential of a forestry enterprise. Existing methods of economic analysis are not adapted to the industry characteristics of enterprises, as well as they do not take into account all the properties of enterprises in the forestry industry, thus, they are needed to be transformed.

Issues of analytical assessment of financial potential of forest enterprises are relevant for stakeholders at different levels. The issues of analytical support of the financial potential management of the enterprise as a whole or its separate components concerning the issues of economic analysis were raised by багатьма scientists: Kozhukhivska [1] found that the process of enterprise potential management should be based on the use of a systematic approach, which involves the capacity assessment of resources and their rational use in the current circumstances. Kosinova [2] suggested a methodical approach to the development of a financial strategy based on an analysis of the strategic potential of the enterprise by calculating the integrated indicator (SPt). With its help one can determine the best type of financial strategy. Bondarenko [3] in their study have developed measures to optimize the strategic management system. Corea and Delfmann [4], Cherchata [5], Denner [6] concluded that the correctness of business processes depends on the efficiency of the financial potential of enterprises. Dopp [7] argue that it is advisable to use a taxonomy method to more thoroughly evaluate the financial potential of businesses. Uguen and Lassudrie [8] say that in order to accumulate financial potential in an enterprise, it is necessary to implement a “Scalable Uncertainty Management” (SUM), which will supplement the taxonomy method and eliminate the potential risks. He [9] use a mathematical model in their work to investigate the relationship between financial decentralization and economic efficiency of enterprises. Shmidt and Khudyakova [10] suggested to estimate the financial potential of economic entities on the basis of probabilistic and statistical methods. Valaskova [11] examined the financial risks of Slovak entities and formed a forecasting model that is implemented by identifying significant forecasts that affect the financial potential of enterprises and their future development. Viktorovna [12] states that the rational use of working

capital has a significant impact on the production process, financial results of the enterprise and its financial potential.

Andrusiv [13] and Kinash [14] say that development of business entities is possible in a country with stable economic growth. Kinash [15] argues in their research that it is advisable to use different methods of mathematical analysis to analyze the potential of enterprises, since this greatly expands the possibility of identifying "bottlenecks". Sergiienko [16] have developed methodical provisions for applying taxonomic analysis to analyze the financial potential of enterprises, which will help to diagnose the presence and depth of crisis phenomena development. Kashik and Snapka [17], Herbane [18] suggest to mitigate potential crises in enterprises based on the application of business agreements of multifunctional process. In his work, Laue [19] suggests a method for analyzing the potential for improving processes and organizational changes at enterprises. Gašparović [20] propose the creation of an innovative multidimensional green infrastructure monitoring system in Zagreb (Croatia), which will enable spatial analysis to improve the decision support system for better forest management. Adamowic [21] in his work proposes to estimate the property of forest areas using the book value method. However, it did not prove to be quite effective as the value of the forestland calculated using this method is underestimated. A smaller but significant impact on the estimated value of forest areas is also observed for flows of money related to the Forest Fund. Szramka [22] argue that the lack of a clear definition of the economic sector makes it difficult to accurately determine the impact of economic sectors on the development of the Polish forestry. Forestry is focused on three main sectors of the economy: agriculture, industry and services. Scientists propose to consider the development of Polish, multifunctional forestry through the lens of sustainable economic and social development. Scientists in Croatia and Slovenia, in particular Ostoić [23], argue that forests and green areas contribute to human well-being. They have also concluded that it is necessary to regulate the urban forestry as a profession. Krajter Ostoić [24] considered in their work how citizens of Southeastern Europe were satisfied with the work of timber processing enterprises through a general face-to-face questionnaire. The analysis showed that the most urgent problem is the unfair behavior of timber processing enterprises, the quality and condition of the facilities, as well as their management and maintenance.

Paying tribute to the significant contributions of the listed scientists to the development of economic science, particularly to the development of a set of methodical support of economic analysis as well as assessment of financial potential of enterprises, we note that the dynamism of the economic environment and industry specificity of the forestry enterprises activity leads to a change in the management system vector and, accordingly, requires a new approach to the analytical support of such a system. As a result, there is a need to evaluate new requirements to the management system as well as to develop of innovative methods of financial potential economic analysis of forestry enterprises.

The aim of the article is to develop an innovative method of economic analysis of the financial potential of forestry enterprises of Ukraine.

METHODOLOGY

To achieve the goal, a number of research methods were used in the work. Theoretical generalization method aimed at a deeper study of the issue of financial potential of enterprises. A method of content analysis was used to analyze the various approaches, methods and models on the basis of which the financial potential is assessed; tabular and graphical method was used in order to display information about the state of financial potential of enterprises and to build a model of their taxonomic analysis. A method of systematic approach, abstraction and formalization was used to form the preconditions, limitations, assumptions and hypotheses adopted in developing a methodology for comprehensive assessment of the financial potential of forestry enterprises and structuring indicators to calculate an integrated taxonomic indicator. Matrix method was used in order to form an observation matrix. The aim of the method of analysis and synthesis, modeling, comparison and analogy was to carry out the analytical procedures for assessing the financial potential of forestry enterprises, testing them on the example of forestry enterprises and building the rating of forestry enterprises by the level of financial potential. Economic and mathematical method (taxonomic analysis) aimed at developing a comprehensive model for assessing the financial potential of forestry enterprises.

The authors consider it expedient to choose the period of 2015-2018, as it was during this period that the positive trends of GDP growth in Ukraine after the economic crisis of 2008-2009 were observed.

The empirical data that was used in the analysis was collected in two ways: database analysis and direct observation. As the authors are representatives of the Higher School of Ukraine, this study used data collected by the authors in the course of their scientific work. Five forestry enterprises were observed and piloted in the course of this study. Electronic databases [25] were also analyzed. In particular, the financial and management reporting of five forestry enterprises were analyzed. The financial statements of the analyzed companies were also used to calculate the financial ratios, in particular, the Statement of Financial Results – Form No. 2, the balance sheets of enterprises – Form No. 1. For example, indicators such as net income (Form No. 2), assets, current assets, inventories, and receivables (Form No. 1) were used to calculate business activity ratios. To calculate liquidity ratios, current assets, current engagements monetary assets and their equivalents (Form No. 1) were used. For profitability ratios the authors took into account net profit, net income, net financial result from operating activities (Form No. 2). For the coefficients that characterize financial stability, current assets, stockholder equity, liabilities were used (Form No. 1).

THE THEORETICAL PART

Taxonomic analysis model of forestry enterprises financial potential

The above-mentioned information allowed to establish the sequence of taxonomic method use in the complex assessment of the forestry enterprises financial potential (Fig. 1). In general, taxonomic analysis of any object begins with the definition and evaluation of the system of indicators that characterize this object, with subsequent formation of their matrix of observations.

Representation of the initial data in the form of a matrix allows us to estimate the change in the magnitude of the investigated features concerning different objects as well as one object for different time periods. Thus, the data concerning the objects (or years) form rows, and the values of the indicators are the columns of the observation matrix X of the dimension (m · n) of the properties (attributes) of the multidimensional units:

$$X_{mn} = \begin{pmatrix} X_1 \\ X_2 \\ \dots \\ X_i \\ \dots \\ X_m \end{pmatrix} = \begin{pmatrix} X_{11} & X_{12} & \dots & X_{1j} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2j} & \dots & X_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ X_{i1} & X_{i2} & \dots & X_{ij} & \dots & X_{in} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ X_{m1} & X_{m2} & \dots & X_{mj} & \dots & X_{mn} \end{pmatrix} \quad (1)$$

where:

m – number of units of n-dimensional space, corresponding to the number of matrix rows;

n – number of each unit properties, corresponding to the number of matrix columns;

x_{ij} – the value of the property by the number j for the unit by the number i.

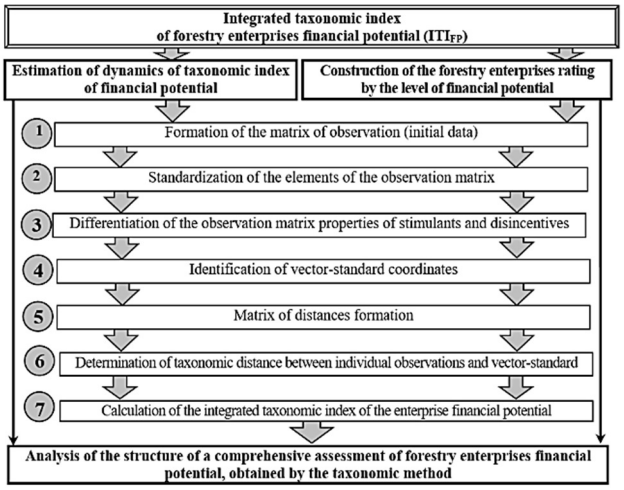

Fig. 1 Model of Taxonomic Analysis of Financial Potential

For the purpose of forming the initial data for taxonomic analysis of forestry enterprises financial potential, on the basis of expert assessments and taking into account the components of financial potential, as well as the relevant indicators of their evaluation, a system of analytical indicators has been developed for the calculation and comparison of integrated taxonomic indexes for a number of objects (forestry enterprises) and in time, in particular, four categories of indicators have been distinguished in terms of:

- financial stability – the ratio of maintenance of current assets by own funds (R_{MCAOF}), working capital maneuverability ratio (R_{WCM}), the ratio of financial independence (autonomy) (R_{aut});
- business activity – assets turnover ratio (R_{AT}), current assets turnover ratio (R_{CAT}), stocks turnover ratio (R_{ST}), accounts receivable turnover ratio (R_{ART});
- liquidity: current liquidity ratio (R_{CL}), quick liquidity ratio (R_{QL}), absolute liquidity ratio (R_{AL});
- profitability: return on equity (ROE)/return on assets (ROA) by net profit (R_{As}), return on sales by the profit from operating activity (R_{SOpA}), stability of economic growth ratio (R_{SEG}).

The next step is to standardize the characteristics of the matrix of observation, which avoids differences with the units of measurement of the attributes, since they describe the various properties of objects, may have different dimensions and, accordingly, are not comparable with each other.

Mathematically, this transformation is carried out according to the following formula (Hellwig [26], Plyuta [27]):

$$Z_{ij} = \frac{x_{ij} - \overline{x_j}}{\sigma_j} \quad (2)$$

where:

Z_{ij} – standardized property j for the *ith* period (of the object)

$\overline{x_j}$ – the arithmetic mean of jth indicator

σ_j – the standard deviation of the jth index:

$$\sigma_j = \left[\frac{1}{m}\sum_{j=1}^{n}\left(x_{ij} - \overline{x_j}\right)^2\right]^{\frac{1}{2}} \quad (3)$$

Thus, the standardization of the properties involves replacing each value of the observation matrix by a coefficient calculated as the ratio of the deviation of the value of each specific indicator from the average value of the indicator for all objects (or periods) to the standard deviation of this indicator.

To determine the standardized data, the mean and the mean square deviation for each indicator of financial potential in the initial data system of five forestry enterprises have been calculated. Formation of the matrix of standardized values of indicators is given in Table 2.

After the standardization of the values of the initial matrix, the differentiation of the properties by dividing them into stimulants (the increase of which improves the assessment of the financial potential of object under research) and the disicentives (deterioration of the estimation of financial potential) has been carried out.

The distribution of properties on stimulants and disicentives is the basis for constructing a vector-standard (P_0), which is formed according to the rule: properties with the maximum values are selected among properties-stimulants, and properties with the minimum values are selected among the properties-disicentives. Consequently, for each *jth* property of the matrix of standardized attributes, the "best" values of the property Z_{0j} are distinguished among all *m* units and form the coordinates of the vector-standard P_0:

$$\begin{cases} Z_{0j} = maxZ_{ij}, \text{ if } j \in I, \\ Z_{0j} = minZ_{ij}, \text{ if } j \notin I (j = 1, \dots m) \end{cases} \quad (4)$$

where:
I – a set of stimulants.
It should be noted that all the indicators identified for the integrated assessment of financial potential are stimulators.
Accordingly, based on the elements of the standardized matrix (Table 2), we determine the coordinates of the vector-standard for each forestry enterprise under the study:

- SE "Malyn Forestry": P_0 = {0.75; 1.04; 1.25; 0.94; 1.05; 1.30; 1.41; 0.86; 1.09; 1.00; 1.46; 1.49; 1.00};
- SE "Narodychi Specialized Forestry": P_0 = {0.85; 0.94; 0.86; 0.07; 1.49; 1.45; 0.92; 0.90; 0.63; 1.20; 1.25; 1.17; 0.80};
- SE "Novograd-Volynsk State Forestry and Hunting Station": P_0 = {1.00; 1.39; 0.75; 0.91; 1.21; 0.89; 1.40; 1.10; 0.80; 1.25; 1.07; 0.89; 0.94};
- SE "Horodnytske Forestry": P_0 = {0.57; 1.40; 0.29; 0.99; 1.01; 1.48; 1.19; 0.75; 0.80; 1.00; 1.23; 1.36; 0.85};
- SE "Korostyshiv Forestry": P_0 = {0.79; 0.92; 0.67; 0.86; 1.25; 1.45; 1.48; 0.93; 1.43; 1.00; 0.84; 1.16; 1.37}.

At the next stage, the distance between individual observations and the vector-standard has been determined by constructing the distance matrix:

$$C_{ij} = \left(Z_{ij} - Z_{0j}\right)^2 \tag{5}$$

where:
Z_{0j} – standardized value of indicator *j* at point-standard.
Based on the formed distance matrix, the taxonomic distance between individual observations and the vector-standard (C_{i0}) is directly determined by the formula [26, 27]:

$$C_{i0} = \sqrt{\sum_{j=1}^{n}\left(Z_{ij} - Z_{0j}\right)^2} \tag{6}$$

It is important to emphasize that the closer the unit of the population under the study to the point-standard is, the smaller will be the value C_{i0} and, accordingly, the quality of the property under the study will be higher.
On the basis of calculation of this indicator it is possible to make up a provisional rating of development of the financial potential of the enterprise, as well as to determine partial (intermediate) taxonomic indicators for its components: financial stability, business activity, liquidity and profitability.
By analyzing the partial indicators of a comprehensive assessment of financial potential, it should be remembered that the closer the unit of the population under the study is to the point-standard, the higher the quality of the property under the study. That is, the best indicator among the studied periods is the lowest indicator and, accordingly, the reduction of the calculated taxonomic indicators is a positive trend and indicates a strengthening of financial capacity and, conversely, an increase in such indicators suggests a deterioration of financial capacity.
Determination of the taxonomic distance for each object is an initial element for calculating the integrated taxonomic index of financial potential (ITI_{FP}) of forestry enterprises (summarized on the basis of Bondareva and Sariyeva [28], Gorodnov and Romanchik [29], Kuzenko [30]:

$$\mathrm{I}TI_{FP} = 1 - d_i \tag{7}$$

where:
d_i – taxonomy ratio:

$$d_i = \frac{C_{i0}}{C_0} \tag{8}$$

C_0 – quality index of the functioning of the object under the investigation in the *ith* period:

$$C_0 = \overline{C}_0 + 2\sigma_0 \tag{9}$$

$\overline{C}_0$ – arithmetic mean from previously calculated distances between standardized indicators in the *ith* period and in the standard:

$$\overline{C}_0 = \frac{\sum_{i=1}^{n} C_{i0}}{n} \tag{10}$$

σ_0 – mean square deviation from point-standard:

$$\sigma_0 = \sqrt{\frac{\sum_{i=1}^{n}\left(C_{i0} - \overline{C_0}\right)^2}{n}} \tag{11}$$

The calculated integrated taxonomic index of financial potential is interpreted as follows: object under the investigation in this period has the higher level of financial potential, the closer to the unit is the value of its level indicator.
Continuing the consideration of the issue, it should be noted that taxonomic analysis will be incomplete, and the conclusions concerning it will not be well-grounded without proper evaluation of its structure. Therefore, at the last stage, it is very important to determine the importance (influence) of the selected indicators in the comprehensive assessment of the phenomenon under the study. In particular, it is necessary to analyze the structure of the taxonomic index for conclusions about the influence of the selected components of the financial potential on the results of its taxonomic analysis.
The evaluation structure is characterized by the specific weight of the contribution of each component of the financial potential to the integrated taxonomic index (its weight) and, accordingly, is determined by the formula:

$$w_{ij} = \frac{\left(Z_{ij} - Z_{0j}\right)^2}{\sum_{j=1}^{n}\left(Z_{ij} - Z_{0j}\right)^2} \times 100 \tag{12}$$

where:
w_{ij} – the importance of the indicator in the evaluation of this object for the relevant period.
The overall influence of the selected indicators on the integrated assessment of the level of financial potential of the enterprise will be determined as the arithmetic mean of the calculated shares:

$$\overline{w_j} = \frac{\sum_{j=1}^{n} w_{ij}}{n} \tag{13}$$

RESULTS

To assess the dynamics of the financial potential integrated taxonomic index based on the financial reporting data of five forestry enterprises of Zhytomyr region, the calculation of the above indicators has been performed and the corresponding observations matrix for the 2015-2018 period has been formed (Table 1).

Table 1

Results of intermediate calculations for constructing a standardized matrix

Indicators	SE Malyn Forestry		SE Narodychi Specialized Forestry		SE Novograd-Volynsk SFHS		SE Horodnytske Forestry		SE Korostyshiv Forestry	
	$\overline{x_j}$	σ_j	$\overline{x_j}$	σ_j	$\overline{x_j}$	σ_j	$\overline{x_j}$	σ_j	$\overline{x_j}$	σ_j
R_{MCAOF}	-0.44	0.16	-0.09	0.27	0.57	0.04	-0.66	0.14	-0.39	0.33
R_{WCM}	-1.51	0.46	-4.49	23.87	0.66	0.31	-0.72	0.25	-2.52	1.95
R_{aut}	0.57	0.08	0.60	0.07	0.71	0.04	0.63	0.04	0.39	0.03
R_{AT}	3.73	0.71	4.30	0.30	3.06	0.22	4.71	1.37	3.88	0.36
R_{CAT}	12.33	4.94	15.22	8.02	5.01	0.43	20.60	5.94	8.82	1.56
R_{ST}	17.39	4.36	65.95	52.20	12.68	1.92	42.30	21.37	13.19	8.96
R_{ART}	54.96	37.77	29.33	4.93	23.02	6.99	52.11	17.94	36.29	17.18
R_{CL}	0.70	0.07	0.70	0.51	2.31	0.20	0.60	0.04	0.75	0.14
R_{QL}	0.26	0.11	0.57	0.31	1.48	0.45	0.32	0.05	0.28	0.07
R_{AL}	0.03	0.03	0.12	0.10	0.80	0.56	0.02	0.02	0.01	0.01
R_{As}	8.89	11.15	14.83	10.44	15.74	8.64	8.80	7.65	7.80	5.05
R_{SOpA}	3.07	2.90	4.42	2.71	6.09	3.11	2.43	1.10	2.45	1.41
R_{SEG}	-0.01	0.02	-0.13	0.40	-0.01	0.18	-0.07	0.13	0.00	0.13

We will select indicators that correspond to the industry specificity, namely: financial stability, business activity, profitability and liquidity of forestry enterprises to analyze the financial potential.

To determine the standardized data, the mean and the mean square deviation for each indicator of financial potential in the initial data system of five forestry enterprises have been calculated.

Formation of the matrix of standardized values of indicators is given in Table 2.

Table 3 presents distance matrixes for determining the taxonomic indicator of forestry enterprises financial potential, which allowed to calculate partial taxonomic indices for the separated components of the forestry enterprises financial potential (Table 4).

Table 2

Standardized matrixes of forestry enterprises financial potential

Years	Analytical indicators of financial potential assessment												
	R_{MCAOF}	R_{WCM}	R_{aut}	R_{AT}	R_{CAT}	R_{ST}	R_{ART}	R_{CL}	R_{QL}	R_{AL}	R_{As}	R_{SOpA}	R_{SEG}
SE "Malyn Forestry"													
2015	**0.75**	-0.09	-0.50	-0.94	-0.99	**1.30**	-0.52	**0.86**	**1.09**	-0.67	-0.67	-0.68	-0.50
2016	0.19	0.37	-1.00	-0.77	-0.70	-1.14	-0.87	0.14	0.55	0.33	-0.62	-0.44	-1.00
2017	-1.44	**1.04**	**1.25**	0.77	0.64	-0.13	-0.02	-1.43	-0.64	**1.00**	**1.46**	**1.49**	**1.00**
2018	0.44	-1.33	0.38	**0.94**	**1.05**	-0.03	**1.41**	0.43	-1.00	-1.00	-0.18	-0.37	0.50
SE "Narodychi Specialized Forestry"													
2015	-1.41	0.18	-1.29	-0.15	-0.69	**1.45**	**0.92**	-0.04	0.23	-1.20	-1.11	-1.07	-1.45
2016	0.30	-1.41	-0.14	0.03	-0.39	-0.34	-1.38	0.53	0.60	-0.10	0.25	0.45	**0.80**
2017	0.33	**0.94**	0.71	**0.07**	**1.49**	-0.28	-0.05	-1.37	-0.91	0.20	**1.25**	**1.17**	0.40
2018	**0.85**	0.29	**0.86**	0.05	-0.41	-0.83	0.50	**0.90**	**0.63**	**1.20**	-0.39	-0.54	0.23
SE "Novograd-Volynsk State Forestry and Hunting Station"													
2015	-0.75	**1.39**	**0.75**	-1.41	0.19	0.83	**1.40**	-0.55	-1.31	-1.16	-1.05	-1.02	-1.28
2016	**1.00**	-0.65	**0.75**	0.32	**1.21**	-1.01	-0.89	**1.10**	0.76	0.11	0.61	0.83	**0.94**
2017	0.50	-0.81	-0.25	**0.91**	-0.21	**0.89**	-0.01	0.50	**0.80**	**1.25**	**1.07**	**0.89**	0.61
2018	-1.25	0.03	-1.25	0.18	-1.19	-0.71	-0.50	-1.10	-0.27	-0.21	-0.63	-0.70	-0.33
SE "Horodnytske Forestry"													
2015	-1.50	**1.40**	0.14	-1.17	-1.16	**1.48**	0.27	-1.50	**0.80**	-1.00	-0.86	-0.71	-1.46
2016	**0.57**	-0.08	-0.36	-0.47	-0.48	-0.70	-1.20	**0.75**	**0.80**	0.50	-0.77	-0.79	0.54
2017	0.43	-0.56	**0.29**	0.66	0.63	-0.43	-0.26	0.00	-0.80	-1.00	**1.23**	**1.36**	**0.85**
2018	0.43	-0.80	-0.14	**0.99**	**1.01**	-0.35	**1.19**	**0.75**	-0.80	**1.00**	0.40	0.13	0.08
SE "Korostyshiv Forestry"													
2015	-1.45	**0.92**	0.33	-1.22	-0.24	**1.45**	**1.48**	-1.50	-1.14	-1.00	-1.45	-1.22	-0.48
2016	0.27	0.41	**0.67**	**0.86**	**1.25**	-0.16	-0.43	0.14	**1.43**	-1.00	**0.84**	**1.16**	**1.37**
2017	0.36	0.07	0.33	0.75	0.15	-0.50	-0.35	0.29	-0.14	**1.00**	0.39	-0.26	-0.17
2018	**0.79**	-1.41	-1.67	-0.39	-1.16	-0.79	-0.71	**0.93**	0.00	0.00	0.22	0.32	-0.87

Table 3

Matrix of distances

Years	Analytical indicators of financial potential assessment												
	R_{MCAOF}	R_{WCM}	R_{aut}	R_{AT}	R_{CAT}	R_{ST}	R_{ART}	R_{CL}	R_{QL}	R_{AL}	R_{As}	R_{SOpA}	R_{SEG}
SE "Malyn Forestry"													
2015	0.00	1.27	3.06	3.55	4.16	0.00	3.72	0.00	0.12	2.78	4.52	4.71	2.25
2016	0.32	0.45	5.06	2.94	3.08	5.96	5.19	0.51	0.04	0.44	4.31	3.73	4.00
2017	4.79	0.00	0.00	0.03	0.17	2.04	2.05	5.24	1.92	0.00	0.00	0.00	0.00
2018	0.10	5.60	0.77	0.00	0.00	1.76	0.00	0.19	3.06	4.00	2.71	3.46	0.25
SE "Narodychi Specialized Forestry"													
2015	5.10	0.59	4.59	0.05	4.73	0.00	0.00	0.89	0.16	5.76	5.55	5.02	5.06
2016	0.31	5.55	1.00	0.00	3.52	3.20	5.28	0.14	0.00	1.69	1.00	0.51	0.00
2017	0.27	0.00	0.02	0.00	0.00	3.02	0.94	5.17	2.36	1.00	0.00	0.00	0.16
2018	0.00	0.43	0.00	0.00	3.59	5.23	0.17	0.00	0.00	0.00	2.69	2.91	0.33
SE "Novograd-Volynsk State Forestry and Hunting Station"													
2015	3.06	0.00	0.00	5.38	1.05	0.00	0.00	2.72	4.46	5.81	4.49	3.63	4.92
2016	0.00	4.14	0.00	0.35	0.00	3.61	5.24	0.00	0.00	1.31	0.21	0.00	0.00
2017	0.25	4.82	1.00	0.00	2.01	0.00	1.99	0.36	0.00	0.00	0.00	0.00	0.11
2018	5.06	1.84	4.00	0.53	5.74	2.55	3.61	4.84	1.14	2.14	2.88	2.53	1.62
SE "Horodnytske Forestry"													
2015	4.28	0.00	0.02	4.66	4.72	0.00	0.86	5.06	0.00	4.00	4.37	4.28	5.34
2016	0.00	2.19	0.42	2.14	2.23	4.77	5.72	0.00	0.00	0.25	3.99	4.63	0.10
2017	0.02	3.84	0.00	0.11	0.14	3.65	2.10	0.56	2.56	4.00	0.00	0.00	0.00
2018	0.02	4.84	0.19	0.00	0.00	3.34	0.00	0.00	2.56	0.00	0.69	1.52	0.60
SE "Korostyshiv Forestry"													
2015	5.04	0.00	0.11	4.34	2.23	0.00	0.00	5.90	6.62	4.00	5.23	5.66	3.43
2016	0.27	0.26	0.00	0.00	0.00	2.58	3.64	0.62	0.00	4.00	0.00	0.00	0.00
2017	0.18	0.72	0.11	0.01	1.22	3.79	3.34	0.42	2.47	0.00	0.20	2.00	2.38
2018	0.00	5.41	5.46	1.56	5.81	5.03	4.79	0.00	2.04	1.00	0.39	0.71	5.00

Table 4

Results of taxonomic analysis of forestry enterprises financial potential in terms of its components

Years	Financial stability		Business activity		Liquidity		Profitability	
	ITI	Rating	ITI	Rating	ITI	Rating	ITI	Rating
SE "Malyn Forestry"								
2015	2.52	4	3.38	3	1.70	2	3.39	3
2016	0.88	1	4.14	4	0.99	1	3.47	4
2017	2.36	2	2.07	2	2.68	3	0.00	1
2018	2.39	3	1.33	1	2.69	4	2.53	2
SE "Narodychi Specialized Forestry"								
2015	3.21	4	2.19	2	2.61	3	3.95	4
2016	2.62	3	3.47	4	1.35	2	1.23	2
2017	0.54	1	1.99	1	2.92	4	0.40	1
2018	0.65	2	3.00	3	0.00	1	2.43	3
SE "Novograd-Volynsk State Forestry and Hunting Station"								
2015	1.75	1	2.54	2	3.60	4	3.61	4
2016	2.04	2	3.03	3	1.14	2	0.47	2
2017	2.46	3	2.00	1	0.60	1	0.33	1
2018	3.30	4	3.53	4	2.85	3	2.65	3
SE "Horodnytske Forestry"								
2015	2.07	3	3.20	3	3.01	4	3.74	4
2016	1.62	1	3.85	4	0.50	1	2.95	3
2017	1.96	2	2.45	2	2.67	3	0.00	1
2018	2.25	4	1.83	1	1.60	2	1.68	2
SE "Korostyshiv Forestry"								
2015	2.27	3	2.56	2	4.06	4	3.78	4
2016	0.73	1	2.49	1	2.15	3	0.00	1
2017	1.00	2	2.89	3	1.70	1	2.14	2
2018	3.30	4	4.15	4	1.74	2	2.47	3

As we can see, from the total number of investigated enterprises, during the 2015-2018 period, there is no stable tendency to increase the partial taxonomy ratios, indicating that the forestry enterprises activities are financially unsustainable, as at all five enterprises at the end of 2016 there was the deterioration of the level of almost all components of the financial potential, the exceptions are the level of business activity at the SE "Malyn Forestry" and at the SE "Horodnytske Forestry", as well as the level of liquidity at the SE "Narodychi Specialized Forestry". At the same time, it is necessary to note 2017, which had the highest taxonomic figures for the three components of financial capacity at two enterprises: SE "Narodychi Specialized Forestry" (the level of financial stability, business activity as well as profitability has increased) and SE "Novograd-Volynsk State Forestry and Hunting Station" (the level of business activity, liquidity and profitability has increased). Also, in 2017, the highest level of profitability was observed in 4 out of 5 forestry enterprises, with the exception of the SE "Korostyshiv Forestry", which in 2015 had the only a high level of liquidity. In addition, this year, only one enterprise (SE "Narodychi Specialized Forestry"). The most negative was 2015, as it had the highest number of lowest values of the partial taxonomic indicators, in particular, at three enterprises (SE "Novograd-Volynsk State Forestry and Hunting Station", SE "Horodnytske Forestry" and SE "Korostyshiv Forestry"), the lowest level of liquidity and profitability has been observed. At the same time, one of the five enterprises and four components of financial potential in the same enterprise (SE "Novograd-Volynsk State Forestry and Hunting Station") had the highest partial taxonomic index of financial stability. In general, the highest level of financial stability was in 2016 (three enterprises), business activity in 2015 and 2018 (two enterprises), liquidity in 2016 and 2017 (two enterprises), and profitability in 2017 (four enterprises).

The implementation of the given algorithm for constructing a taxonomic index has been carried out in the MS Excel, and the results of calculations are given in Table 5. Thus, the calculation of integrated taxonomic indexes for five forest enterprises for 2015-2018 period confirms preliminary conclusions regarding the absence of a pronounced tendency to increase the size of financial capacity in most enterprises (in four out of five enterprises), as well as the lowest level of financial potential of the majority of enterprises in 2015 (in three out of five enterprises – the 4th place in the general rating and in two – the 3rd place) and the highest – in 2017 (in three out of five enterprises – the 1st place in the overall rating and two – 2nd place).

In addition, by the end of 2018, there is a decrease in the level of financial potential for four enterprises (SE "Malyn Forestry", SE "Narodychi Specialized Forestry", SE "Novograd-Volynsk State Forestry and Hunting Station" and SE "Korostyshiv Forestry"), except for the SE "Horodnytske Forestry", which clearly shows the tendency towards gradual growth of financial potential during 2015-2018 period due to significant improvement of the level of business activity of the enterprise, that is, acceleration of rotation of its circulating assets and revitalization of operational activity, and also consolidation of liquidity level. Based on the distance matrix, an estimation of the structure of taxonomic analysis of the dynamics of financial potential of five forestry enterprises has been made which revealed the components of the financial potential that had the greatest impact on the formation of an integrated taxonomic index of financial potential of forestry enterprises during 2015-2018 period. The results of this analysis have been summarized in Table 6.

Table 5

Results of calculating the integrated taxonomy index of forestry enterprises financial potential for 2015-2018 period

Enterprise	*Years*	C_{i0}	$\bar{C}_0$	σ_0	C_0		Rating
SE "Malyn Forestry"	2015	5.49	5.05	0.87	6.79	0.19	3
	2016	6.00				0.12	4
	2017	4.03				**0.41**	1
	2018	4.68				0.31	2
SE "Narodychi Specialized Forestry"	2015	6.12	4.59	1.13	6.84	0.11	4
	2016	4.71				0.31	3
	2017	3.60				**0.47**	1
	2018	3.92				0.43	2
SE "Novograd-Volynsk State Forestry and Hunting Station"	2015	5.96	4.82	1.49	7.80	0.24	3
	2016	3.86				0.51	2
	2017	3.25				**0.58**	1
	2018	6.20				0.20	4
SE "Horodnytske Forestry"	2015	6.13	4.78	1.09	6.96	0.12	4
	2016	5.14				0.26	3
	2017	4.12				0.41	2
	2018	3.71				**0.47**	1
SE "Korostyshiv Forestry"	2015	6.52	5.02	1.53	8.08	0.19	4
	2016	3.37				**0.58**	1
	2017	4.11				0.49	2
	2018	6.10				0.25	3

Table 6

The structure of taxonomic analysis of forestry enterprises financial potential by its components during 2015-2018 period

Enterprise	Year	The structure of the taxonomic index of financial potential by its components, %				
		Financial stability	Business activity	Liquidity	Profitability	Tota
SE "Malyn Forestry"	**2015**	14.37	37.92	9.62	38.09	100.00
	2016	16.18	47.65	2.75	33.42	100.00
	2017	29.50	26.42	44.09	0.00	100.00
	2018	29.54	8.04	33.11	29.32	100.00
	Average	22.40	30.01	22.39	25.21	100.00
	Rating	**3**	**1**	**4**	**2**	**X**
SE "Narodychi Specialized Forestry"	**2015**	27.41	12.75	18.16	41.68	100.00
	2016	30.90	54.05	8.24	6.80	100.00
	2017	2.24	30.60	65.92	1.24	100.00
	2018	2.80	58.57	0.00	38.63	100.00
	Average	15.84	38.99	23.08	22.09	100.00
	Rating	**4**	**1**	**2**	**3**	**X**
SE "Novograd-Volynsk State Forestry and Hunting Station"	**2015**	8.61	18.10	36.57	36.71	100.00
	2016	27.86	61.91	8.82	1.41	100.00
	2017	57.59	37.95	3.42	1.04	100.00
	2018	28.32	32.32	21.10	18.26	100.00
	Average	30.60	37.57	17.47	14.36	100.00
	Rating	**2**	**1**	**3**	**4**	**X**
SE "Horodnytske Forestry"	**2015**	11.44	27.24	24.10	37.22	100.00
	2016	9.87	56.20	0.95	32.98	100.00
	2017	22.73	35.34	41.93	0.00	100.00
	2018	36.70	24.27	18.60	20.42	100.00
	Average	20.19	35.76	21.40	22.65	100.00
	Rating	**4**	**1**	**3**	**2**	**X**
SE "Korostyshiv Forestry"	**2015**	12.10	15.44	38.82	33.65	100.00
	2016	4.66	54.71	40.63	0.00	100.00
	2017	6.00	49.64	17.16	27.20	100.00
	2018	29.22	46.21	8.17	16.40	100.00
	Average	13.00	41.50	26.20	19.31	100.00
	Rating	**4**	**1**	**2**	**3**	**X**

The conducted research allow to assert, that at all investigated forestry enterprises the level of their financial potential in general depends more on the speed of assets rotation and the efficiency of using the available resource potential, i.e., on the level of business activity of such enterprises, Figure 2. At the same time, the smallest influence on the formation of the taxonomic index of financial potential had a level of financial stability for three out of five enterprises (SE "Narodychi Specialized Forestry", SE "Novograd-Volynsk State Forestry and Hunting Station", SE "Korostyshiv Forestry").

Continuing consideration of the issue, in accordance with the suggested model of taxonomic analysis of financial potential (Fig. 1), we determine the rating of the selected five forestry enterprises of Zhytomyr region.

Based on the matrix of observation and standardization of its properties as well as on the matrix of taxonomic distances, we estimate the dynamics of the forestry enterprise ranking according to their financial potential, and we will build the rating of the forestry enterprises by the level of financial potential during 2015-2018 period (Table 7).

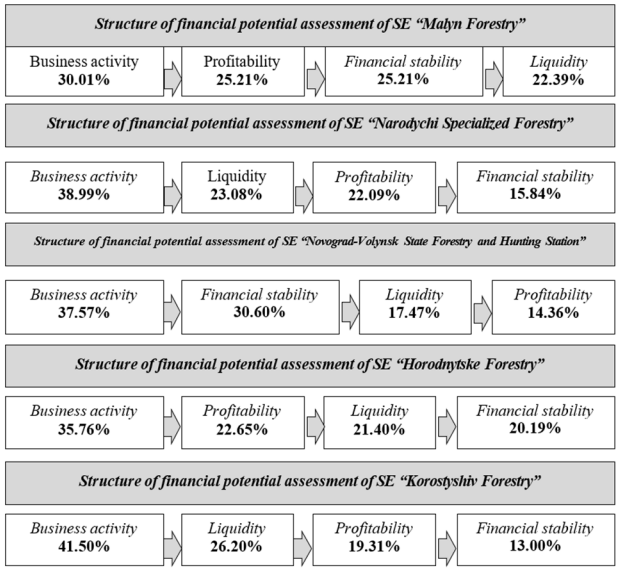

Fig. 2 Ranking of components of forestry enterprises financial potential by their importance in the calculation of the integrated taxonomic index

Table 7

The rating of forestry enterprises by the level of financial potential during 2015-2018 period

Years	*Enterprises*	C_{i0}	$\bar{C}_0$	σ_0	C_0		Rating
2015	SE "Malyn Forestry"	7.05	6.25	0.98	8.21	0.14	4
	SE "Narodychi Specialized Forestry"	5.95				0.28	3
	SE "Novograd-Volynsk SFHS"	5.00				**0.39**	**1**
	SE "Horodnytske Forestry"	5.85				0.29	2
	SE "Korostyshiv Forestry"	7.42				0.10	5
2016	SE "Malyn Forestry"	7.38	5.92	1.06	8.04	0.08	5
	SE "Narodychi Specialized Forestry"	4.91				0.39	2
	SE "Novograd-Volynsk SFHS"	4.85				**0.40**	**1**
	SE "Horodnytske Forestry"	6.28				0.22	4
	SE "Korostyshiv Forestry"	6.16				0.23	3
2017	SE "Malyn Forestry"	6.21	6.08	1.16	8.40	0.26	4
	SE "Narodychi Specialized Forestry"	5.19				**0.38**	**1**
	SE "Novograd-Volynsk SFHS"	5.26				0.37	2
	SE "Horodnytske Forestry"	5.72				0.32	3
	SE "Korostyshiv Forestry"	8.03				0.04	5
2018	SE "Malyn Forestry"	6.59	5.94	1.32	8.58	0.23	4
	SE "Narodychi Specialized Forestry"	4.49				**0.48**	**1**
	SE "Novograd-Volynsk SFHS"	5.23				0.39	2
	SE "Horodnytske Forestry"	5.52				0.36	3
	SE "Korostyshiv Forestry"	7.87				0.08	5

Having determined the rating of the analyzed enterprises, we see that among the analyzed indicators in the structure of the assessment of financial potential the first place is occupied by business activity. Liquidity ranks second, profitability ranks third and financial sustainability ranks fourth. Therefore, it is advisable to propose an innovative model of the financial potential of the enterprise as an object of economic analysis (Figure 3), which will allow to identify the totality of the properties of the object as a basis for forming a set of analytical procedures for assessing its state.

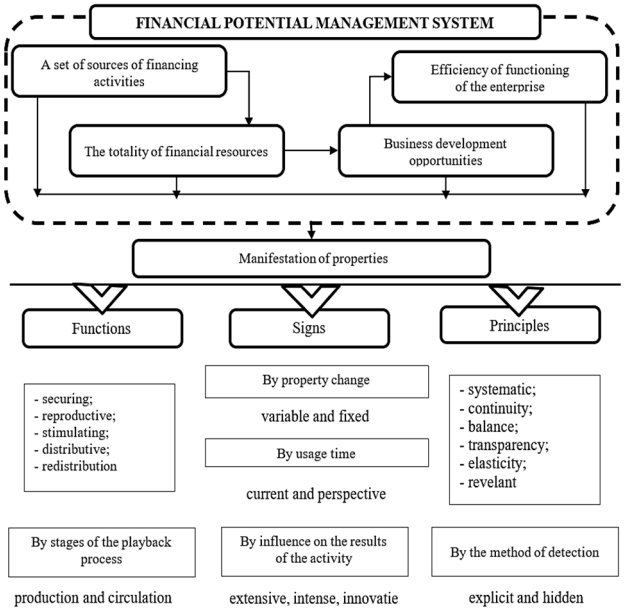

Fig. 3 Innovative model of financial potential of forestry enterprises as an object of economic analysis

CONCLUSIONS

Content analysis of relevant economic literature has shown that there are many different approaches, methods and models on the basis of which financial potential is assessed. Therefore, the components of the financial potential can be completely different and use different systems of measures (monetary, natural, ratios, interest, etc.). However, despite the diversity of existing approaches, due to the relevance of such studies, the number of methods for assessing the financial potential of enterprises is gradually increasing. In this regard, there was an objective need to develop a comprehensive innovative model of assessing the financial potential of forestry enterprises, which will allow them to optimize their financial and economic activities, timely diagnose the presence of crisis phenomena and provide relevant information to stakeholders. The use of one of the economic and mathematical methods i.e. taxonomic analysis is substantiated.

The information and analytical support of financial potential management of forestry enterprises is analyzed through the introduction of an integrated taxonomic indicator, the procedure of which involves two directions:

1) assessment of the dynamics of the taxonomic indicator of financial potential;

2) rating of forestry enterprises by the level of financial potential. This made it possible to identify areas for improving financial policy and to determine the impact of external and internal threats on the level of financial potential.

The innovative model of estimation of financial potential of forestry enterprises is proposed, which provides the manifestation of its properties through functions (providing, replicating, stimulating, distributive and redistribu-

tive, indicative), principles (systematicity, continuity, balance, transparency, elasticity, relevancy) and classification attributes (depending on the tendency to vary (variable and fixed); by the time of use (current and promising); by the reproduction process stages (production and circulation); by the nature of influence on the enterprise activity results (extensive, intensive, innovative); by the detection method (explicit and implicit).

Research results may be the basis for managerial decision-making aimed at optimizing the financial potential of enterprises.

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