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Modelling the Process of Assessing the Corruption Orientation of Regulatory Legal Acts

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Abstract. In the conditions of growing requirements for methods and means of combating negative phenomena of society, prevention and deterrence of corrupt actions of officials by creating new and editing old normative legal acts can significantly limit the development of such offenses and have a positive effect on the economic state of the country. The urgent task is to develop simple and effective methods of modelling and assessing the level of corruption orientation of normative legal acts. The paper examines the problem of quantitative assessment of the negative phenomenon of corrupt activity of officials, which can be stimulated by regulatory and legal acts. The purpose of the article was to improve the methods and techniques of analysis of the process of assessing the quality of normative legal acts by modelling their corruption orientation. The methods of fuzzy set theory and fuzzy logical inference, as well as the methods of probability theory are used in the process of modelling the quantitative assessment of the level of corruption oriented legal acts. The proposed approach makes it possible to simultaneously take into account separate criteria that are based on subjective assessments and have uncertainties of various natures, and are also characterized by a large number of them with their inequality and antagonism. At the same time, the modelling process provides the possibility of using both a clear and unclear representation of the initial data, reduces the influence of subjectivity of expert evaluation factors of a heuristic nature. There is no need to determine the weight of each individual factor when forming a global criterion for deciding on the level of corruption orientation of a normative legal act. On the basis of the obtained values of the global criterion, a decision is made to choose one or another variant of the normative legal act. The paper examines the stages of implementation of the proposed approach to assessing the level of corruption orientation of the normative legal act on the reclamation of forestry lands disturbed as a result of amber mining. The results of the work can be useful in the development of drafts of new legislation, as well as for researchers of methods of control and management of complex technical and economic systems

Keywords: fuzzy set, membership function, linguistic variable, quality indicator, random variable, membership probability

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INTRODUCTION

In a state where there is no sufficient control over corrupt activities, any agreement between private and public sector entities, by means of which public assets are illegally transformed into private ones, can occur. This corruption is often used as a synonym for a high level of legislative corruption. The performance of the authority's actions is based on legislative and regulatory legal acts (RLA), which establish powers and restrictions on the work of officials. Some actions may have a corruption component (corruption risk). Identifying factors that influence the existence or increase of the corruption risk is a very difficult and urgent task. Even an approximate solution to such a task will provide an opportunity to change the RLA for the better and prevent corruption offenses. Article 15 of the Law of Ukraine "On Principles of Preventing and Combating Corruption" [1] establishes the obligation to carry out anti-corruption expertise of draft regulatory legal acts. The use of a scientific approach to the formalization of the process of such an examination helps to increase its efficiency and objectivity. The works [2-4] are devoted to the problem of assessing the state of complex technical, economic, and organizational systems. Quantitative evaluation of the

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corruption orientation of the legislation occupies a separate niche, which previously received little attention among the many studies. To eliminate the negative impact on society, the main anti-corruption programs are adopted in Article 19 of the Law of Ukraine "On Prevention of Corruption" [1]. A partial implementation of this law is the methodology for managing corruption risks in the activities of government bodies [2], which forms the methodology for assessing the quality of RLAs, and also notes the following: classification of corruption risks by categories and types; stages of assessment of RLA corruption risks. Quantitative assessments in [2] take into account only precisely defined discrete data, which does not make it possible to make a continuous assessment of corruption risks, which are of a vague nature.

In the works [3-4] authors examine the issue of assessing the reliability of the functioning of complex technical systems under the conditions of extreme impacts and a shortage of resources for their restoration. At the same time, methods of forecasting indicators of survivability of the executive element of the special purpose system are being developed on the basis of analytical-stochastic modelling of the conflict situation. The indicator of the quality of system functioning is the mathematical expectation of the number of executive elements of the special purpose system that have retained their ability to perform tasks effectively. According to the results of the study, obtaining results is based on statistical and grapho-analytical modelling of processes, which can take into account the importance of various parameters only by introducing their weighting factors of influence on the state of the system. At the same time, the value of these coefficients can change very significantly over time. This can lead to systematic erroneous results in decision-making. Works [5-6] are devoted to the solution of an actual scientific and technical problem – the development of models and methods of forming project portfolios based on the method of their actualization, identification and selection of projects based on the evaluation and prioritization of portfolios. To determine priority projects, a method has been developed, which is based on the definition of a generalized priority criterion for each project, the coefficient of its budget burden and the formation of a ranking table. The basis of the table formation process is statistical data, which may not always exist in sufficient volume, and sometimes they are absent. Otherwise, the ranking process is based on the judgment of experts, which has a very high level of uncertainty, which is not taken into account when making a decision. In work [7], the issue of evaluating the corruption orientation of RLA is considered, taking into account the unclear nature of the factors, but a significant drawback is that the result of the calculation can only be clear data. In [8-10], the task of vague assessment of the state of technical and economic systems is solved, while the possibility of taking legal concepts into account as a component of the assessment is not analysed.

Thus, it is problematic to evaluate the corruption of a regulatory legal act by the usual numerous methods, since the components of the evaluation system have different physical dimensions, and many of them are defined only at the conceptual level. Thus, the authors consider it expedient to propose to evaluate the corruption of the RLA using the apparatus of fuzzy set theory and fuzzy logical conclusion. The essence of the mentioned approach is that, having conducted a numerical evaluation of the conceptual components from the positions of fuzzy logic, correctly bring them to the same proportionality, and then, based on a fuzzy logical conclusion, obtain a systematized conclusion about the effectiveness of the RLA norms. The main goal of this study is to improve the methods and methods of analysis of the process of assessing the quality of normative legal acts by modelling their corruption orientation. The object of the research is the process of assessing the corruption orientation of normative legal acts. The subject of the study is the methods of fuzzy analysis and decision-making in conditions of data uncertainty.

MATERIALS AND METHODS

The following scientific methods were used in the study: methods of the theory of fuzzy sets and fuzzy logical inference, as well as methods of the theory of probabilities. Assessment of whether fuzzy values of a parameter (indicator) belong to its possible fuzzy states. The state of the parameter can be represented as a linguistic variable that has multiple values, from negative to positive. In the process of analysing a parameter, its membership in the i-th fuzzy set should be determined using the membership function $\mu_i(x_0)$, where i is the number of the set by which this function is defined. It exists on the entire set of values of the parameter or linguistic variable, x_0 is the numerical value of the parameter. It is worth noting that the number x_0 can simultaneously belong to one or several states with different degrees of belonging. It should be noted that the general membership of the fuzzy parameter x cannot be less than 1 for any value of x on the set X:

$$\sum_{i=1}^{n} \mu_i(x \in X) = 1, \quad (1)$$

where x is the value of the parameter; n is the number of possible states of the parameter; X is a set of parameter states; $\mu_i(x)$ is a membership function of the parameter belonging to the i-th fuzzy set.

The consequence of expression (1) is that the i-th membership function of belonging to the corresponding i-th state becomes a complement to the set of functions of belonging to all other states, for example:

$$\sum_{i=1}^{n-1} \mu_i(x \in X) = 1 - \mu_n(x \in X). \quad (2)$$

It is worth noting that there can be no degree of belonging to emptiness. But, a situation is possible in which the variable cannot be determined, then it can be assumed that x_0 = NULL or an unknown value. The existence of an unknown or empty parameter value is possible when it is impossible to determine it or there is a complete absence of any statistical data. All possible parameter values of any complex system will be modelled by a linguistic variable. At the same time, there cannot be unknown values of linguistic variables. In order to formalize this possibility, the concept of programming – NULL – membership (belonging) was used [11].

The value of the parameter can be specified by a clear number $x = x_0$ when it belongs to one state from a set of existing states. This state is characterized by the membership function $\mu_i(x = x_0)$. However, the value of the parameter can be characterized by an interval or a fuzzy number. In this case, the degree of belonging to each or one of the states, as well as the probability of making a decision about its belonging to the selected state, can be considered as a characteristic of the parameter. The first characteristic belongs to the theory of fuzzy sets, and the second one to the theory of probabilities. Each of the above concepts describes the degree of knowledge or ignorance about the true position of the parameter. Deciding whether a clear parameter should belong to any of the states is an event that has a probabilistic nature, so the probability of belonging to one or another state can serve as an additional characteristic of a vague parameter. The probability of belonging of a parameter that has a clear value $x = x_0$ of state M, which has a membership function $\mu_i(x = x_0)$ should be estimated. To perform this task, the method of dividing a fuzzy number at the α-level is most often used [12]. The probability that the parameter $x = x_0$ belongs to the state M at the level α_i is determined in accordance with the expressions:

$$\begin{gathered} P_M(x_0, \alpha_i < \mu_i(x=x_0), \mu_i(x=x_0)=1)=1; \\ P_M(x_0, \alpha_i < \mu_i(x=x_0), 0<\mu_i(x=x_0)<1)=p_i; \\ P_M(x_0, \alpha_i > \mu_i(x=x_0), \mu_i(x=x_0)>0)=0; \\ P_M(x_0, \alpha_i >= \mu_i(x=x_0), \mu_i(x=x_0)=0)=0 \end{gathered} \quad (3)$$

where α_i is the i-th alpha level; P_M is the probability that the variable x at the point x_0 belongs to the state M at the α_i-level. It should be noted that, based on the interval approach, a clear value of the parameter x_0 at the level α_i exists in the interval α_i when $\alpha_i < \mu_i(x=x_0)$ and $\mu_i(x=x_0)=1$, therefore, the probability of belonging to state M is equal to 1. Level α_i can be below the values of the function $\mu_i(x=x_0)<1$ and $\mu_i(x=x_0)<1$, then a clear parameter that has a value of x_0 at the level of α_i can be attributed to another state, so the probability of belonging to the state M $P_M(x_0, \alpha_i)=p_i<1$. The level α_i can be above the values of the function $\mu_i(x=x_0)<1$ and $\mu_i(x=x_0)=0$, then a clear parameter that has the value x_0 at the level α_i exists in the interval of the level α_i of the given state M, and the probability of belonging to the state M is equal to 0.

Suppose that the parameter *x* is a fuzzy number and it can belong to several fuzzy sets. In this case, the use of the classical concept of the degree of belonging to a fuzzy state from a set of states to estimate the parameter does not always give an objective result [11]. The result of the intersection of a fuzzy set (number x) with a set of fuzzy sets (numbers M_1 and M_2) is a set of fuzzy sets (fuzzy numbers *A* and *B*), which can serve as a basis for evaluating whether a parameter belongs to one or another state. In [10] fuzzy numbers *A* and *B* are compared, the probabilities of events $P(A<B)$, $P(A=B)$, $P(A>B)$ are determined. Such characteristics also do not give an idea of whether the parameter belongs to fuzzy states (*M1* and *M2*). In this case, the concept of belonging has a probabilistic nature, so it can be about the probability of belonging of one fuzzy number to another. A parameter that is not precisely defined is formally described by a fuzzy number *x*. A precisely undetermined parameter is formally described by a fuzzy number *x*. This number is represented by the membership function $\mu(x)$, of various shapes – triangular, trapezoidal or any other. In the general case, both the value of the parameter x and the membership function are functions of time $x(t)$, $\mu(x, t)$. It should be noted that the membership function takes into account the value of the parameter *x* when $\mu(x, t)>0$ is fulfilled. The occurrence of another condition will be considered impossible (with a probability equal to 0). In accordance with the definition of the empty set and the above-mentioned possible values of the linguistic variable, such values can be characterized by NULL-belonging. It can be concluded that the region of possible or admissible clear values of a parameter that has a membership function that satisfies the condition $\mu(x, t)>0$ with probability $P(x, \mu(x,t))>0))=1$ forms fuzzy characteristic of the parameter.

To analyse the level of belonging, as well as probabilistic characteristics of fuzzy data, the division of numbers on the α-level is used [10]. At the same time, intervals are compared, which are determined at a certain α-level of fuzzy numbers. Based on the results of such a comparison, it is possible to draw a conclusion about the probability of belonging or not belonging of one fuzzy number to another. The probabilities of a fuzzy parameter belonging to two fuzzy sets can be determined in accordance with [11] using the formulas:

$$\begin{gathered} P_{M1}(x=x_i)=\mu_1(x=x_i)p(x=x_i); \\ P_{M2}(x=x_i)=\mu_2(x=x_i)p(x=x_i). \end{gathered} \quad (4)$$

where P_{M1}, P_{M2} are the probabilities of fuzzy parameter x belonging to two fuzzy sets; x_i is the current value of the parameter; $p(x=x_i)$ is the probability of the event $x=x_i$. The probability that the parameter $x \in x_i$ belongs to the M_1 state at the α_j level can be determined by the formula [13]:

$$P_{M1}(x \in x_i, \alpha_j)=P(x \in x_i)P(\alpha_j), \quad (5)$$

where $P(x \in x_i)$ is the probability that the parameter x belongs to the interval x_i;$P(\alpha_j)$ is the probability of the α_j-level; $P_{M1}(x \in x_i, \alpha_j)$ is the probability that the parameter x belongs to the set M_1 at the level α_j. Since the values of α are chosen randomly, the probability that the level set α_j is chosen is $P(\alpha_j)=\alpha_j-\alpha_{j-1}$. Then, the probability that the fuzzy variable $x \in x_i$ belongs to the fuzzy state M_1 at all possible α-levels is determined in accordance with the expression:

$$P_{M1}(x \in x_i) = \sum_{j=1}^{n}(\alpha_j - \alpha_{j-1})P(x \in x_i), \quad (6)$$

or

$$P_{M1}(x \in x_i)=\alpha_n P(x \in x_i) \quad (7)$$

where *n* is the number of α-levels. Based on the fact that $\alpha_n=\mu_1(x=x_i)$ and taking into account expression (4):

$$P_{M1}(x \in x_i)=\mu_1(x=x_i)\mu(x=x_i)\Delta p(x=x_i), \quad (8)$$

where $\Delta p(x=x_i)$ is the probability of occurrence of the event $x=x_i$ in the interval Δx. Then, the membership of two fuzzy sets of the fuzzy parameter *x* is estimated by the clear probability and is calculated by the formulas:

$$\begin{gathered} P_{M1}(x) = \sum_{i=0}^{n}\mu_1(x_i)\mu(x_i)\Delta p(x_i); \\ P_{M2}(x) = \sum_{i=0}^{n}\mu_2(x_i)\mu(x_i)\Delta p(x_i). \end{gathered} \quad (9)$$

Moving on to the continuous representation of variables, the probability of a fuzzy number belonging to two fuzzy states can be determined:

$$P_{M1}(x) = \int_0^1 \mu_1(x)\mu(x)dp$$
$$P_{M2}(x) = \int_0^1 \mu_2(x)\mu(x)dp. \quad (10)$$

With a uniform distribution of a random variable, the interval Δp is determined by the formula:

$$\Delta p = \Delta x/(x_k - x_0), \quad (11)$$

where x_0 is the lower limit of the interval $[x_0, x_k]$ of the parameter x; x_k is the upper limit of the interval $[x_0, x_k]$ of the parameter x. After replacing the variable according to (11):

$$P_{M1}(x) = \frac{1}{x_k - x_0}\int_{x_0}^{x_k} \mu_1(x)\mu(x)dx\,;$$
$$P_{M2}(x) = \frac{1}{x_k - x_0}\int_{x_0}^{x_k} \mu_2(x)\mu(x)dx. \quad (12)$$

The sum of the probabilities of a fuzzy parameter belonging to two fuzzy states is equal to 1:

$$P_{M1} + P_{M2} == \frac{1}{x_k - x_0}\int_{x_0}^{x_k} \mu_1(x) + \mu_2(x))\mu(x)dx. \quad (13)$$

Taking (2) into account:

$$P_{M1} + P_{M2} == \frac{1}{x_k - x_0}\int_{x_0}^{x_k} \mu(x)dx. \quad (14)$$

Based on (4):

$$\int_{x_0}^{x_k}(x)dx = x_k - x_0, \quad (15)$$

Then the expression (13) is transformed into the form:

$$P_{M1} + P_{M2} = 1. \quad (16)$$

On the basis of the obtained expressions (4), (12), the probability of fuzzy values of the parameter (indicator) belonging to its possible fuzzy states is determined. This makes it possible to formalize conceptual components from the standpoint of fuzzy logic; to compare fuzzy parameters of different nature and measurement units; evaluate the state of parameters in the absence of statistical data.

In order to assess the impact of a regulatory legal act on the activity of the enterprise, the following assumptions should be made: the norm of law may or may not be used for corruption purposes; with an increase in the probability of using the norm for corrupt purposes, the belonging to this norm to the set of corrupt ones increases; since there is no statistic of the membership function $\mu(x)$ of law norms to the set of corrupt ones, they should be considered as an equivalent; the function $M(x)$ of the simultaneous belonging also of norms $\mu_i(x)$ to the set of possible non-corrupt actions is determined according to the expression [14]:

$$M(x) = \prod (1 - \mu_i(x)). \quad (17)$$

Development of a model for the process of assessing the corruption orientation of a regulatory legal act. The assessment of the corruption of regulatory legal acts and their actions requires complex knowledge and the application of methods of both legal science and sociological, general scientific, statistical and other methods. In modern research, the theory of fuzzy sets is widely used both in technology and in economics. It has a developed mathematical apparatus and is used to solve complex problems in which statistical data cannot be obtained. However, these methods are practically not used to analyse RLA corruption. In order to use fuzzy set methods to assess the corruption of RLAs, it is necessary to perform the following stages [15]: to determine the indicators that can affect the level of corruption of RLAs; to establish the level of influence of the indicator on the corruption of the RLA; to build indicator classification levels; to evaluate the current level of each indicator; to classify the current level of indicators; to establish the general indicator of corruption of the RLA; to determine the current level of the general indicator of corruption of the RLA. Quantitative analysis of RLA corruption is based on the selection of objective indicators that describe various aspects of this phenomenon. They, on the one hand, influence the assessment of corruption of the RLA, and on the other hand, assess the level of its maturity [16]. A set of indicators $Y = \{y_i\}$ of N number should be formed.

The indicators the level of influence on the corruption of the RLA or the level of significance of each are assigned. To simplify the evaluation process, it should be assumed that the indicators have the same weight or have the same effect on the assessment of the corruption of the RLA. Levels by which the values of indicators can be classified are formed. For the ui indicator, which will characterize the probability of the occurrence of factors contributing to the corruption of the RLA, the full set of its values is divided into several subsets: y_{i1} – the subset "low level of support for RLA corruption"; y_{i2} – the subset "average level of promoting RLA corruption"; y_{i3} – the subset "high level of promoting RLA corruption"; y_{i4} – the subset "very high level of promoting RLA corruption". Moreover, it can be assumed by default that the increase in indicators is connected with the increase in corruption of the RLA. Based on these definitions, the classification levels for indicators are set (Table 1).

Table 1. Levels of classification of values of the probability of occurrence of factors contributing to the corruption of RLAs

Levels of classification	The name of the subset
$0.75 < y_{14} < 1$	Very high level of promoting RLA corruption
$0.5 < y_{13} < 0.75$	High level of promoting RLA corruption
$0.25 < y_{12} < 0.5$	Average level of promoting RLA corruption
$y_{11} < 0.25$	Low level of support for RLA corruption

Source: developed by the author

Table 1 defines the clear limits of the classification levels of the values of each indicator. When forming fuzzy levels of classification of indicators, it is necessary to specify their fuzzy subsets with overlapping boundaries. For example, each of these subsets can be given by a number that has the form of a trapezoid (Fig. 1).

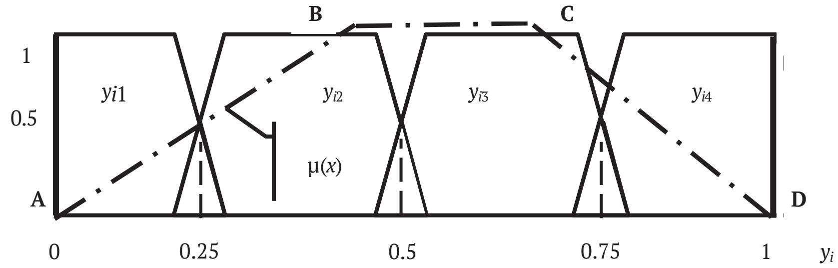

Figure 1. Levels of classification of values of the probability of occurrence for factors contributing to the corruption of RLAs

Source: developed by the author

At the next stage, the probability of the function μ(x) (trapezoid ABCD) (Fig. 1) is determined to each of the possible states of the factor according to formula (12). At the stage of establishing the integral indicator of RLA corruption, it should be defined as the probability of belonging to one of the states of the set of independent factors according to the expression [16]:

$$Pi=\sum_k \prod_j p_{jk}, \; i=1..Z, \qquad (18)$$

where Z is the number of possible fuzzy states of the integral indicator; P_i is the probability of the integral indicator belonging to the i-th state; p_{jk} is the probability of the j-th indicator belonging to the k-th state. The Z value is determined according to the degree of detail of the assessment, while the level of classification of the indicator values can be set similarly to Figure 1. But it is also possible to stop on only three states (low, medium and high). As a result, according to each of the states, we will get numbers that characterize the level of promotion of corruption by the RLA.

RESULTS AND DISCUSSION

The definition of promoting corruption should be considered using the example of the regulatory legal act on the reclamation of forestry lands disturbed as a result of amber mining [17]. At the first stage, a set of individual indicators that affect the assessment of the corruption of the RLA is determined. For this purpose, Table 2 shows the responsibilities stipulated by the example of the contract between the customer and the contractor, and their corruption risks are assessed. The "Description" column lists the factors from the source [18]. It should be assumed that the level of influence of each indicator (factor) on the assessment of RLA corruption is equivalent.

Table 2. Factors provided by the example of the contract between the customer and the contractor and assessment of their risks

No.	Description	Risk
1	During the geological study, including the experimental and industrial development of amber, 100% of the discovered amber is recovered during the experimental and industrial development	Concealment of the discovery of minerals and development of land intended for reclamation
2	Reproduction of forests on reclaimed land	Lack of the desired result
3	The possibility of involving third parties and contractors	Transferring responsibility for breach of contract, its non-fulfilment to third parties
4	In the course of the work, ensure that employees comply with the requirements of nature protection, forest and land legislation, norms, rules of labour protection, man-made and fire safety	Non-compliance with norms and rules
5	The Customer does not have the right to make any claims regarding any property received by the Contractor during the exercise of his powers	Obstructing the work of the customer

Source: developed by the authors basing on [18]

The classification levels of the values of each of the five indicators in accordance with Figure 1 were constructed. The current level of belonging to the promotion of corruption of each of the indicators is evaluated. To do this, their membership functions $\mu_i(x)$, $i = 1, \dots 5$ were defined. The first indicator (factor) of concealing the fact of the discovery of minerals and the development of land intended for reclamation greatly affects the promotion of corruption in the RLA.

According to [19-20] it should be determined that with the probability of using the norm for corruption purposes starting from 0.5, the function of belonging to this can be set to 1 ($\mu_1(x) = 1$). If this probability is less than 0.5, then the function $\mu_1(x)$ can be considered linear in the range from 0 to 1. Then it will have the following form: $\mu_1(x) = 2x$ (Fig. 2).

The formation of the functions of belonging to the promotion of corruption of each of the last four indicators (Table 2) in view of the absence of information can be based only on the assumption of its linear dependence on the probability of occurrence of this event [18].In this case, this function will have the following form: $\mu_2(x) = x$ or $\mu_i(x)$, $i = 2, 3, 4, 5$ (Fig. 2). The results of the calculation according to formula (12) of the probability of function $\mu_i(x)$ belonging to each of the possible states or levels of factor classification are shown in Table 3.

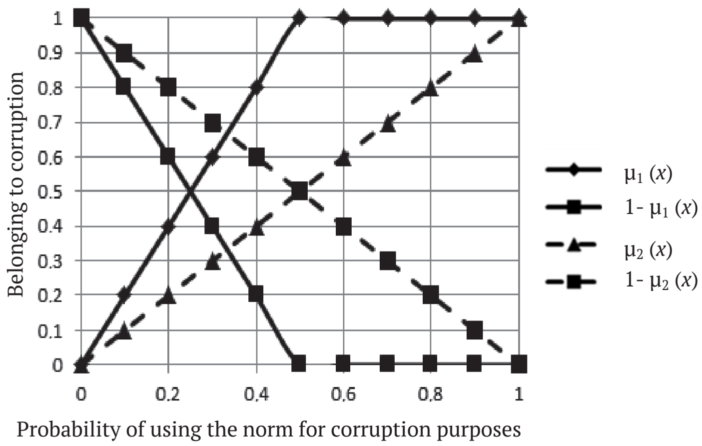

Figure 2. Functions of belonging to the promotion of corruption

Source: created by the authors basing on [18]

Table 3. Probability of belonging to the factors contributing to the corruption of the RLA to the levels of classification of the values of y_i

Factors contributing to RLA corruption	Levels of classification			
	y_1	y_2	y_3	y_4
Factor 1	0.09	0.23	0.34	0.34
Factor 2 (3, 4, 5)	0.072	0.192	0.314	0.422

Source: developed by the authors

An indicator of the promotion of corruption by the RLA is formed. At the same time, it should be assumed that it has three states (from a low to a high level of promoting RLA corruption), the classification levels of which are shown in Table 4.

It should be noted that all membership functions are defined rather conditionally or on the basis of expert assessments. In order to eliminate such an element of bias in the definition of membership functions, it is possible to create several rules for the formation of integral indicators of the level of belonging to each of the three states of RLA corruption. In the example, two variants of rule formation are considered. For example, the hard and soft versions of the rules are shown in Table 5.

Table 4. Levels of classification of the probability of promoting corruption by the RLA

Levels of classification	Name of indicator states
$0.70.05<y_в<1$	High level of promotion of RLA corruption
$0.30.05<y_с<0.7+0.05$	Average level of promoting RLA corruption
$y_н<0.3+0.05$	Low level of promotion of RLA corruption

Source: developed by the authors

Table 5. Rules for determining the probability of belonging to the levels of promoting corruption by RLA

State	A strict version of the rule	A soft version of the rule
High level of corruption	Only one indicator has a high or very high level of promoting corruption, the others are the norm	Two of the factors have a high or very high level of promoting corruption, and the others are the norm
Low level of corruption	Three indicators out of five have a low level of promoting corruption, the others are not above the norm	Two indicators out of five have a low level of promoting corruption, the others are not above the norm
Average level of corruption	In all other cases	In all other cases

Source: developed by the authors

Based on the above considerations, the limit values of clear intervals of the probability of RLA belonging to low $[P^1_{H1} - P^1_{H2}] = [0.219 - 0.287]$, medium $[P^1_{C1} - P^1_{C2}] = [0.38 - 0.42]$ and high $[P^1_{B1} - P^1_{B2}] = [0.293 - 0.401]$ intervals can be determined.

Determining the corruption orientation of the RLA requires taking into account heuristic data, which have a very high level of uncertainty and cannot be formalized by means of analytical-stochastic modelling. The lack of the possibility of obtaining statistical data does not allow the methods proposed in works [3-6] to be used to solve the problems of assessing the state of complex systems, which are characterized by many heuristic indicators. In addition, predicting changes in some indicators can be very problematic or simply impossible. Therefore, obtaining initial data for processing the results of assessing the level of corruption orientation of the RLA by the methods outlined in [7; 9-10] needs additional research. The methodology outlined in work [2] is directly devoted to assessing the corruption risk of RLA, it is based on heuristic expert assessments and some initial data can be used in this study.

Methodology [2] assesses two components of corruption risk. This is the corruption risk, which is assessed by three levels (low, medium or high) and the levels of possible consequences of the corruption offense (low, medium or high). Accordingly, the numbers 1, 2, 3 are assigned to each level (low, medium, high). Corruption risk is defined as the product of the level of the occurrence of corruption risk by the level of the consequence of a corruption offense. At the same time, a scale is established by which the corruption risk is determined (Table 6) [2].

Table 7 shows an example of applying the methodology [2] when determining each of the components and the overall level of corruption risk in accordance with the regulatory legal act on the reclamation of forestry lands disturbed as a result of amber mining.

Table 6. Degrees of corruption risk

Risk level	Risk assessment
Low	from 1 to 2 points
Middle	from 3 to 4 points
high	from 6 to 9 points

Source: [2]

Table 7. Determination of the level of corruption risk

Risks	Probability of an offense related to corruption (points)	Consequences of an offense related to corruption (points)	Degree of corruption risk	Level of corruption risk
Indicator 1	2	3	6	High
Indicator 2	1	2	2	Low
Indicator 3	2	2	4	Average
Indicator 4	3	3	9	High
Indicator 5	2	2	4	Average

Source: developed by the authors based on [2]

According to the rules (Table 5), this regulatory act belongs to a high level of corruption promotion for both hard and soft variants of the formation of the integral indicator, since two indicators have a high level. Based on the results obtained when determining the intervals $[P^1_{H1} - P^1_{H2}]$, $[P^1_{C1} - P^1_{C2}]$, $[P^1_{B1} - P^1_{B2}]$ during the conducted research, it can be concluded that this RLA rather belongs to the medium level of promoting corruption.

It should be emphasized that the approach [2] to the formalization of corruption risks has significant shortcomings in the formation of a global criterion, which can lead to systematic erroneous assessment results:

- the scale for determining the degree of corruption risks is not continuous (it is impossible to assess risks with scores of 5, 7, 8), this reduces the reliability of decision-making results;
- the results of comparing different degrees of corruption risks cannot characterize their real difference, for example, the difference between a high and an average degree of risk is 2 points, and two values of a high degree of risk can differ by only 3 points;
- a low level of corruption risk for any of the components (1 point) does not affect the overall degree of corruption risk;
- a large number of parameters and a high level of their uncertainty are not taken into account;
- clear boundaries are established between the difference in risk levels for all possible assessments, although the task of assessing the level of corruption risk has a fuzzy nature.

To eliminate these shortcomings, a fuzzy-set approach to the analysis of corruption risk of RLA is used. Each data obtained by processing partially or fully heuristic information has a fuzzy nature. Therefore, the representation of numerical information by an interval or a fuzzy value more objectively describes the characteristics of the subject area. However, when forming the membership functions of the indicators, the level of their uncertainty should also be taken into account. In view of this, the values of the probability intervals of RLA belonging to the low $[P^1_{H1} - P^1_{H2}] = [0.219 - 0.287]$, medium $[P^1_{C1} - P^1_{C2}] = [0.38 - 0.42]$ and high $[P^1_{B1} - P^1_{B2}] = [0.293 - 0.401]$ levels can be performed to compare the promotion of RLA corruption. For example, having set the membership function $\mu_2(x) = \mu_1(x)$, the following interval values can be achieved: low $[P^2_{H1} - P^2_{H2}] = [0.196 - 0.23]$, medium $[P^2_{C1} - P^2_{C2}] = [0.385 - 0.43]$ and high $[P^2_{B1} - P^2_{B2}] = [0.34 - 0.419]$. Comparison of intervals can be performed based on the methodology [12]. Accordingly, the probability of exceeding one interval over another is determined [12]. The results of comparing the intervals of probability values of the RLA belonging to the low, medium and high levels are shown in Table 8.

Table 8. The probability of exceeding the intervals

$[P^2_{H1}-P^2_{H2}]>[P^1_{H1}-P^1_{H2}]$	$[P^2_{C1}-P^2_{C2}]>[P^1_{C1}-P^1_{C2}]$	$[P^2_{B1}-P^2_{B2}]>[P^1_{B1}-P^1_{B2}]$
0.06136	0.68	0.565

Source: developed by the authors

Based on the obtained data, it can be concluded that the second version of the RLA significantly increases the promotion of corruption, although it differs in only one membership function out of five. The considered issue of taking into account the level of uncertainty of the membership functions of indicators requires additional research when considering a specific subject area. The example considers the main stages of the process of assessing the level of corruption promotion of the RLA, as a result of which an approximate assessment of the regulatory legal act on the reclamation of forestry lands disturbed as a result of amber mining was obtained, which requires more detailed research. In this way, the process of assessing the level of RLA in relation to the promotion of corruption is reduced to the transformation of the membership functions of each of the corruption factors into a comparison of value intervals.

CONCLUSIONS

Setting the task of assessing the level of the RLA in relation to the promotion of corruption is characterized by a large number and uncertainty of private criteria, their inequality, as well as antagonism. At the same time, it is very important to simultaneously take into account criteria that are based on subjective assessments and have uncertainties of various nature. This leads to the need to process partially or completely heuristic information that cannot be described by clear numerical values. Therefore, the representation of numerical information by an interval or a fuzzy value more objectively describes the characteristics of the subject area.

The work examines in detail the stages of the process of evaluating the corruption orientation of regulatory legal acts. At the same time, it is possible to obtain a quantitative assessment of the negativity of the legislation. The determination of the level of corruption promotion is considered on the example of the legal act on the reclamation of forestry lands disturbed as a result of amber mining. The limit values of clear intervals of probability of RLA belonging to low, medium, and high levels are determined. The question of possible change of the initial data regarding the rules for the formation of the global criterion for deciding on the level of promotion of RLA corruption is considered. The research results are obtained on the basis of modelling using the methods of probability theory, fuzzy sets, and fuzzy logical inference. The proposed approach to assessing the level of RLA in relation to the promotion of corruption has the following features and advantages: the initial data can be presented as clear and fuzzy numbers; private criteria of a different nature are reduced to some relative units, which simplifies the convolution to a global quality indicator; there is no need to determine the weight of each individual indicator; the use of expert evaluations is minimized (only when creating membership functions); the method can be used both to compare the corruption orientation of regulatory and legal acts, and to determine its relative change. For the further development of this work, it is planned to carry out research on the accounting of possible financial losses, which is an additional incentive for the emergence of RLA corruption.

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Моделювання процесу оцінювання корупційної спрямованості нормативно-правових актів

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Анотація. В умовах зростаючих вимог до методів і засобів боротьби з негативними явищами суспільства профілактика та попередження корупційних дій посадових осіб шляхом створення нових і редагування старих нормативно-правових актів може суттєво обмежити розвиток таких правопорушень та позитивно вплинути на економічний стан держави. Актуальним завданням є розроблення простих і ефективних методів моделювання і оцінювання рівня корупційної спрямованості нормативно-правових актів. В роботі розглядається проблема кількісного оцінювання негативного явища корупційної діяльності посадових осіб, яка може бути стимульована нормативно-правовими актами. Мета статті – удосконалення методів і методик аналізу процесу оцінювання якості нормативно-правових актів шляхом моделювання їх корупційної спрямованості. В процесі моделювання кількісного оцінювання рівня корупційної спрямованості нормативно-правових актів використовуються методи теорії нечітких множин та нечіткого логічного висновку, а також методи теорії ймовірностей. Пропонований підхід дозволяє одночасно враховувати окремі критерії, які засновані на суб'єктивних оцінках і мають невизначеність різної природи, а також характеризуються великою кількістю, їх нерівнозначністю і антагоністичністю. При цьому процес моделювання забезпечує можливість використання як чіткого, так і нечіткого представлення вихідних даних, зменшує вплив суб'єктивності експертних оцінок на фактори евристичного характеру. При формуванні глобального критерію прийняття рішення про рівень корупційної спрямованості нормативно-правового акту немає необхідності визначати вагу кожного окремого фактору. На основі отриманих значень глобального критерію приймається рішення про вибір того чи іншого варіанту нормативно-правового акту. У роботі розглянуті етапи реалізації запропонованого підходу до оцінювання рівня корупційної спрямованості нормативно-правового акту про рекультивацію земель лісогосподарського призначення, порушених в наслідок видобутку бурштину. Результати роботи можуть бути корисними при розробці проектів нового законодавства, а також для дослідників методів контролю і управління складними техніко-економічними системами

Ключові слова: нечітка множина, функція приналежності, лінгвістична змінна, показник якості, випадкова величина, ймовірність приналежності