

Factors and Risks in Land Resources Administration System

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Abstract - Performed research is based on the wide use of system analysis, which allows to form a sequence of procedures for the development of managerial decisions and to determine the significance of the impact of their adoption; theoretical-analytical and statistical analysis to justify the expediency of using certain groups of factors for the modeling of land resources administration processes; the methodology for building the theoretical and analytical PESTLE model and the risk theory to evaluate the results of the developed managerial decisions.

The main groups of factors are determined. On this basis, a theoretical and analytical database is formed which can be used for modeling of management decisions; criteria for assessing the risks from decision-making are proposed.

The structural-logical scheme of interconnections between individual factors and their agents, which form the model of making management decisions in the field of land resources, is developed. The results of the research can be effectively used when creating strategic plans for socio-economic development of territories.

Keywords - Administration, Land Resources, Modeling, Factors, Risks, Evaluation.

I. INTRODUCTION

The system of land resources administration (LRA), which links the natural resource potential of the land with external natural phenomena and factors, as well as a combination of other factors, in particular demographic, social, material, legal, and economic, is extremely complex.

Under the system of land resources administration we will understand a complex probable dynamic system that covers the structure of land resources by category of land, their intended use, soil cover, zones of restrictions and encumbrances, forms of ownership, estimated value in combination with the influence of natural phenomena and

processes, as well as social and the demographic status of the territories. Thus, this system is a complex of interconnected elements between its individual objects. Separate items form a system if:

- it can provide its integrity;
- plurality of elements is subject to the unique purpose and criterion of research;
- availability of interconnected subsystems;
- availability of the most important element of the system.

Thus, determining the creation of an adequate model of LRA is an important problem.

In world theory and practice, the problem of land resources administration was widely reflected. Scientific publication of S. Enemark, I. Williamson, J. Wallace, A. Rajabifard [1] is devoted to the building of the modern system of land administration.

The term "land administration" as the basic definition is defined by the United Nations Economic Commission for Europe in 1996 [2]. Land administration - this is a separate part of the overall process of land management, includes a number of combined information resources regarding land plots and their environment.

In the works of A. Osro [3], T. Ostenberg [4], Furre [5], the components of the land resources administration system are proposed, the main of which are: land cadastre, environmental management, land and real estate valuation, land and real estate market, financial provision of land-material relations, political (legislative) acts of land tenure, legal aspects of land and real estate, the possibility of reforming urbanized and agrarian territories.

The great attention of public authorities, scientists and specialists from different countries to the issue of land administration has led to the creation of a special international standard. The draft of international standard for land administration is currently being developed. This standard formulates the basic principles of information communications for land administration purposes, including requirements for source data: administrative, special, land-legal documents, cadastral materials, etc. which involves its adaptation to individual local situations.

The administration of land resources in publications [6-8] is considered as a new land management paradigm, which raises the procedure for the organization, implementation and implementation of land management and land evaluation projects and programs for a new stage of development.

In a number of scientific works the issues of institutional and state management of land resources, their economic value are considered [9-11].

II. RESEARCH METHOD

The performed studies are based on system analysis and statistical data on the establishment of individual factors and their significance in the system of LRA. PESTLE analysis as well as risk assessment criteria, were used to develop strategic LRA solutions in terms of the dynamics of external natural and other processes.

III. RESULT AND DISCUSSION

A. Result of the research

The methodology of creating the factors and the factors for the creation of a model of land resources administration have been developed. The criteria for evaluation of developed solutions are presented.

B. Discussions

In the last period the issues related to the strategic planning of the development of territories have become broadly known.

Administration of land resources includes a complex of various geospatial, economic, social, engineering, historical, cultural, environmental and other factors that need to be taken into account when implementing territorial land management.

However, the lack of exploration of the possibilities of using these factors in modern analytical approaches that are widely used in the planning of economic activity of enterprises and organizations, including for the purposes of land administration, is an important part of the unresolved part of the general problem.

In the process of developing a scientifically grounded model of land administration, at all levels of state and local government, groups of factors and their components should be identified that have the greatest impact on the development of the LRA strategy. This publication is devoted to the study of the main factors that shape the model of LRA and the impact of risks when determining them.

At present, there is no single system of classification of models, but for the most part allocate more than ten classification marks.

By purpose, models are divided into theoretical-analytical and applied. Theoretical and analytical models are used in the modeling and study of general patterns, principles and properties of economic, social, natural phenomena and processes. Applied models of LRA require the availability of input information, which according to the model developer fully reflects the influence of information elements on the initial results of the model. In the course of this stage, territorial analysis of the territories is carried out, using for this purpose land management and urban planning documentation, materials of soil, geobotanical, geomorphological, hydrographic and other special surveys and explorations, which are of fundamental importance for determining the priorities of land resources development.

However, it should be noted that in this case, the elements of the input information, which are especially important for the creation of the model LRA of a particular administrative-territorial unit, may be secondary to the creation of the model of LRA for another. All this depends on many factors: the priority direction of management defined by the territorial communities, state authorities of different levels; the presence of valuable, unproductive, degraded and disturbed lands; the availability of labor and financial resources for implementing the LRA solutions.

In the development of the model of LRA in the case of a small amount of information on the influence of individual factors on the final result, it is necessary to conduct experimental research with numerical model experiments. The results of these studies may be important for establishing the relationships between the individual elements of the model and the end result as a whole.

The peculiarity of the input information when constructing LRA models is, in many cases, its uncertainty, as well as the obtaining of information through expert assessments and judgments.

C. Factors of administration

From the analysis of existing analytical models, the most effective, which will most likely contribute to the development of an adequate model of LRA, may be the PESTLE model. For this model, we will form the main

factors influencing the decision-making in the LRA system (Table 1). At any level of land resources administration, the model should include factors that have the greatest impact on the development of the LRA strategy. We identified the groups of factors that shape the strategy of LRA. In the area of the application of political factors, it is important to reach consensus on the goals of territorial communities with the goals of regional and state interests regarding the use of land in this territory. The development programs of individual administrative units should be closely linked to regional and state target programs.

Economic factors include a number of indicators that characterize the economic benefits or losses from the use of lands of different functional purposes. However, the basis of the development of strategies LRA should serve as a monetary valuation of the land. Monetary valuation is an indicator that characterizes the capitalized value of land and is the main criterion for assessing possible future investments.

In the period of a limited land market (the prohibition of the sale of agricultural land in Ukraine), an important attribute of financial and economic stability of a separate administrative unit is the sale price of the lease, since in this case, the income of the population increases due to the provision of these land plots in short or long-term use for persons with significant capital.

Table 1. Groups of factors in PESTLE model

Factors					
Political, (P)	Economic, (E)	Social&Cultural, (S)	Technological, (T)	Legal, (L)	Ecological, (E)
1	2	3	4	5	6
Targeted programs of regional and local development of land reform	Economic efficiency of land use	Demographic situation	Development of the latest technologies in the use and protection of land	Laws and regulations on land relations	Nature protection zones
Administrative-management system of coordination and control of use, preservation, reproduction and protection of soils	Normative and expert monetary price of land of different categories	Unemployment	Possibilities of development of information technologies	Sectoral norms and standards for land use	Sanitary and hygienic zones
	The estimated value of the rights of land rent for	The level of social and material provision of population	Investments in land resources	Masterplans of the settlements	Water-protective zones
		Intensity of migration		Materials of cadastral	Contaminated lands
					Affected lands

Coordination of interests of local communities with the interests of region, the state	different functional use	Educational level	Newest technologies for mapping of lands according to their categories, use, forms of ownership, agricultural production groups	zoning of territories	Lands of excessive moisture Especially valuable lands Karst territories Erosive areas Flood lands
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Source: authors` study

The development of any strategy for LRA is not an end in itself, it should be aimed, first of all, at meeting the socio-material, cultural and spiritual needs of the population living in this territory. That is, the implementation of the LRA strategy should improve the level of incomes, reduce unemployment and the level of migration, stabilize the demographic decline. All this should closely intertwine with the development of socio-cultural, medical and educational institutions. Without the formation of certain areas of cultural-educational and health-improving infrastructure, the problem of the availability of skilled and able-bodied labor resources becomes a problem.

Investments in land resources are one of the important mechanisms for improving the state of land reform, which has practically ceased, and in some cases it has fallen back (cadastral zoning, demarcation of land, normative monetary valuation, etc.).

The use of state-of-the-art GIS technologies and remote sensing methods will provide reliable, objective and realistic information on the state of the land, their erosion, use, etc. All this will enable the development of adequate real strategic decisions of the LRA, which will contribute to improving the investment climate, and the application of modern technologies in the processes of agro-processing and nature conservation.

The development of the LRA system should be carried out in accordance with the national legal framework, normative legal documents, standards, methodological recommendations and current legal documents of local state administrations and local self-government. It should be considered that the national land legislation does not fully reflect the processes of land-property relations in various spheres of the national economy. In this case, in the

presence of certain objects of the national economy in the given territory, it is necessary to take into account the legislative and regulatory acts of the given sphere in relation to the use of land resources, the establishment of zones of special regime for regimens.

The application of the proposed methodology will determine the priorities in the development of land resources and formulate strategies for the development of individual territorial communities and regions. It should be noted that the overwhelming majority of the methods of priority (most important) factors are determined by expert evaluation, which is based on the conclusions and judgments of expert experts in this field of knowledge or production that allows account to be taken of hidden links between certain groups of factors or factors themselves, which does not allow them to be identified by traditional econometric or mathematical methods.

D. Evaluation of solutions

Considering the process of land administration as a procedure based on making certain decisions when creating a managed management system that takes into account the internal and external interrelations in this system, there is a postulate about determining the degree of trust in this system, establishing economic, environmental and social risks in its use. To a certain extent, the process of land administration is a prediction of the effective use of this natural potential in the future. It should be noted that the reliability of the forecast decision depends on the nature and parameters of uncertainty and the duration of their validity. The structure of the relationship between landowners, private, public and state interests sometimes reaches critical conflict situations, which lead to a breakdown of projected decisions on individual business projects, which in turn,

instead of expected profits, can bring significant losses to investors. This is the essence of socio-economic uncertainty [8].

Note that uncertainty does not mean lack of information about this factor, but only incomplete information about it and the inability to predict its temporal change. Hence, when administering land resources, it is necessary to take into account adverse situations which can lead to negative consequences. Decision-making under uncertainty involves inconsistency of actions of the subject of the business and the environment. The consequence of this process can be the risks of both natural and socio-economic nature. First of all, it is soil contamination, violations of agricultural landscapes, caused by man-made processes, decrease of material welfare of population of territories, etc.

In the period of creation of a socially oriented economy, the active introduction of market mechanisms into the economy increases the importance of the importance of the "risk" category. As a rule, "risk" is objectively present in all spheres of our lives. And in this aspect, when making decisions in the process of administering land resources, it is important not only to correctly assess the degree of risk in specific circumstances and circumstances, but also be able to manage it, thus reducing its negative impact.

Uncertainty is one of the main sources of risk. At the same time, risk is one of the arguments that allows you to determine the degree of influence of uncertainty on the expected result. Thus, the known risk value cannot fully alleviate the effects of uncertainty factors, but allows for the future to develop alternative solutions that, if not eliminated, will reduce the negative impact of uncertainties.

Along with the natural factors of uncertainty in Ukraine, there are a number of other uncertainties. There are, in particular, irresponsibility of business entities; contradictory legislation; high level and fluctuations of inflation; the preponderance of political interests over social and economic ones; unstable tax laws, etc.

An aggregate of a number of factors of uncertainty can lead to a crisis risk situation. The risk situation is usually accompanied by three conditions: the presence of uncertainty, the need to develop an alternative, an assessment of the likelihood of using alternatives. The risk situation can be classified as a kind of uncertainty, in which the probability of occurrence of a particular event can be determined in advance.

Creating a risk situation is conditioned by certain circumstances. In particular, random events, predictable

changes in external and internal factors, the possibility of alternative solutions. These factors characterize the causes of crisis situations, but do not solve the issues of their elimination or reduce the impact on the final result.

In order to eliminate the risk situation, each decision maker takes the one that, in his opinion, is an alternative to the risk situation in certain specific circumstances. At the same time there are two possible variants of the development of events:

- subjective decision-making under uncertainty and risk situation can increase the risk;
- subjective decision-making can reduce or eliminate risk.

The influence of subjectivity on the risk situation depends on many personal factors that the subject of decision-making has.

In modern conditions, the risks in administration of land resources can act as mechanisms of influence of the scientific and technological process and, conversely, as destabilizing factors. Risks stimulate the search for unconventional methods and tools for addressing risk situations, lead to more efficient and productive use of land resources, which is one of the important levers of the impact of scientific and technological progress. On the other hand, in the conditions of uncertainty, the lack of complete information on individual phenomena and processes, ignorance of the laws of their development risks can become the basis for the adoption of voluntaristic decisions.

The main sources that cause risks in the LRA could be: natural phenomena and processes; incompleteness and uncertainty of information about phenomena, process, composition of soil forming rocks, etc.; limited and insufficient financial and human resources for the transformation of lands, improvement of land and their protection; the presence of conflicting interests of society and the state regarding the use of land; accidental events; insufficient level of use of scientifically grounded methods in the field of land management, agriculture, etc.; imbalance of land resources by category of land and land types with territorial planning of the administrative-territorial system.

In the process of LRA it is important to identify the sources of risk. In modern conditions, external legal risk factors are divided into: factors that are caused by actions of international and European standards; factors at the state level; factors caused by regional peculiarities; factors inherent in certain branches of the national economy.

External factors are divided into two groups: direct and indirect action. Factors of direct action are: the variability of the legislative and regulatory framework, but sometimes also its contradictions; unpredictability of actions of state authorities and local self-government; change in tax and financial and credit policy; racketeering, corruption and other non-legitimate actions; the volatility of demand and supply in the land market.

Factors of indirect action - unpredictable changes in the economic nature, caused by inflationary processes, market conditions in the land market, declining solvency of the population; the variability of climatic conditions, the emergence of threatening natural phenomena and processes; changes in the global process - are a large group of risk.

Of course, in real terms it is not possible to take into account all the risk factors, but it is possible to identify the main ones and develop as a result the alternative solutions of the LRA. In a country with a low economic development, the system of LRA practically aims at the survival of business entities and the minimum needs of the population. The risk in the system of LRA is a function of progress, when there is an interest of certain individuals and legal entities, and public authorities in obtaining positive final results.

The formation of the legislative, regulatory, scientific and methodological basis and other documentation should take into account the main risks in the LRA, which requires a clear and logical definition of both the risks themselves and the significance of their impact on the implementation of the LRA. All this requires classification of signs for actions that are common to all types of administrative and management decisions, as well as those that are characteristic of land administration.

Risks by the nature of the action are divided into static and dynamic. The risks caused by the inability of the entity to fully utilize land resources are statistical. The specified risks always cause losses and, depending on the reasons, they are divided into risks caused by natural disasters or processes and due to imperfections of legislative and regulatory documents, as well as due to the actions of external third parties.

It becomes especially difficult for LRA to take into account the dynamic risks that arise from the need to change management decisions due to unpredictable changes in the land market, management practices and the limited use of land in buffer zones or as a result of changing land and

property policy. Thus, the dynamic risks include a range of political, economic and specific risks of land legislation.

The development of programs for the development of territories, social projects in land management, etc. requires a certain time not only for their creation, but also for the implementation of the process in practice. Hence, from the period of development and approval of the land management project developed and approved in accordance with the current legislation, retrospective risks arise from its practical implementation.

The frequent change of political elites in state governance, as it occurs in Ukraine, leads to political risks that are closely linked to the interests of the ruling circles, the polarization of the social strata of the population, which causes a change in the views and interests of local self-government bodies regarding the possibilities of a certain target use of territories administrative units and the adoption of appropriate administrative and managerial decisions on land resources.

During the period of unstable political and economic situation in the country the weight of economic risks has increased. The risk matrix should be used to identify the effects of individual risks on decision making in the LRA

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \dots & \dots & \dots & \dots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix},$$

where: r_{mn} - the risk of a strategy m at a certain state of the factor.

The value of risk is practically the value of the loss due to the unreliability of the data about the state of the environment.

The matrix of risk elements has two main properties: the elements of the matrix are integral numbers; one of the elements of the matrix takes zero.

Regardless of the individual values of the risks, choose a strategy of solutions that would be most beneficial from different points of view in comparison with others. In this case, proposals based on certain criteria (rules) are developed. By means of criteria, it becomes possible to identify the internal connections of the decision-making problem and to reduce the influence of subjective factors.

Criteria for assessing the adoption of managerial decisions are functions that determine the rules for the adoption or selection of the optimal solution.

Different criteria are used in the theory of decision-making in conditions of complete uncertainty. These include Wald's criterion, the criterion of extreme pessimism, which allows determining the receipt of the guaranteed value of the strategy in the worst case scenario.

The criterion of optimism (maximax) is oriented on the most favorable conditions. The specified criterion is used in a situation where it is possible to influence on the factors of action. In this case, the developers of LRA have the opportunity to influence on the state of the factor, as well as the development of appropriate solutions.

The criterion of pessimism is used in the case of the least favorable conditions and uncontrolled factors which are affecting the result.

In many cases, there are risks due to the inability to control some factors. For example, the development of design solutions for land management of the territories a few years ago and their implementation in the current period; change of public interests in the development of territories in time; demographic and socio-economic instability. All this leads to the uncontrollability of these factors, which may negatively affect the implementation of already developed LRA programs. In this case, the criterion of pessimism is used to assess the influence of these factors.

In practice, there are cases where the actual natural factors act on the final result more positively than predicted. Then there is a need to determine the possible deviations of the results from the predicted. For example, the development of erosion processes has stopped, climatic conditions are better than predicted, and so on. In this case, the criterion of mini-max risk of the theory of regret aversion is used to evaluate the decisions made. The essence of this criterion is that the solution is the best when the maximum risk value will be the smallest.

In practice, there are cases where the probability of occurrence of certain stages of factors is known. In this case, the decision in the LRA should be considered as the result of partial uncertainties. To evaluate the decision in these cases, the Bayesian criterion or the Bernoulli-Laplace criterion is applied.

The Bayesian criterion is the criterion for the maximum of average risk.

IV. CONCLUSION

As a result of the carried out research, the main groups of factors and their individual elements are determined, which should be based on the modeling of land administration processes. Depending on the given economic task, the criteria for risk assessment in the adoption of appropriate administrative decisions are proposed.

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