

Total Economic Value Concept: Essence, Evolution and Author's Approach

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Abstract—Total economic value concept operates as a consistent approach for economic evaluation of natural resources in the context of exacerbation of the ecological crisis and overexploitation of natural resources. However, the essence and structure are still the subject of scientific research. This article determines that along with the existence of subjective, ideal and real values, the subjective values are the most interesting from the point of view of economic evaluation and distribution within the framework of the total economic value concept. The presented genesis of the term of “value”, analysis of the total economic value concept development and the theory of ecosystem services contributed to the creation of an author's approach to the distribution of values. We justify the inclusion in indirect value the cultural services as opposed to the direct value; option value takes into account the value in use by future individuals; we remobilize the quasi-option value in the structure of total economic value. The paper provides an improved total economic value model. This model takes into account the time aspect, the understanding of the term “value” and theoretical principles of ecosystem services and author's principle of value evaluation – “based on the best possible alternative”. The practical implications of the research is to improve the economic mechanism of government regulation of natural resource management by clarifying and improving the consistent basis for the economic evaluation of the value of natural resources for making managerial decisions on their involvement in economic turnover.

Keywords—total economic value, ecosystem services, natural resources, option value, quasi-option value, existence value, structure

I. INTRODUCTION

One of the key problem of modern regulation of the world, national and regional economic systems from the standpoint of economic ethics is economic determinism expressed in the dogma of self-regulating “system rationality”, which is cultivated by the liberal economic ideal theory of the “free” market and based on the shareholder value. The rehabilitation of renewable and non-renewable resources is carried out under global difficult conditions, which are the struggle exacerbation for control over the resources and environmental degradation. These are the reasons for some scientific problems arise, such as analysis and evaluation of the value of natural resources not from the standpoint of resource, population and even complex approaches, but from the point of view of a systematic approach within the framework of socio and ecological and

economic programming. Society has an understanding that nature and the environment are not just sources of the exchange value of natural resources for social production, but also in themselves have a consumer value that determines the conditions for the development of humanity itself. Ecological and economic pragmatics dictates the need to consider natural resources as a part of ecosystems, taking into account not only their exchange value, but also their ecosystem functions. The modern solution is the „total economic value concept“ (TEV), which operates as a consistent approach for economic evaluation of natural resources taking into account natural resources within ecosystems. Today the system approach is the most widespread and promising in economic, social [1] and environmental sciences [2,3]. The TEV allows to evaluate all four functions of natural capital: resource, regulatory, cultural and human health function. In present-day literature, there are several variants of the structure of the TEV. One of the most common structures presented in [4,5,6,7,8] is as follows: Total Economic Value = use value + non-use value; use value = direct use value + indirect use value/ ecological value + option value; non-use value = existence value + other non-use values (including bequest value) [6,9]. However, the specialists recognize some contradiction of the structure of the TEV presented above.

We also identify a pluralism of experts’ opinions about the name of the concept: “total economic value” or “total economic cost”, and the use of the terms “price”, “cost”, “value” and “utility” in economic research. Within the article, we propose to use the following definitions:

- we consider cost of the good as the monetary equivalent of its value. Moreover, it is necessary to divide the cost of owning the good from the cost of the good itself;
- value arises in relations with respect to the goods by which it becomes socially significant, its selling is the cost of these goods. Thus, the measurement of cost is only monetary, while value could have an alternative form;
- utility is a „relatively constant“ part of value that reflects the significance of the good in applied and utilitarian aspects. It characterizes the degree of satisfaction with the good;
- price in general is the proportion of the exchange of one good for another or its monetary equivalent. The price acts as the equivalent of the cost of a particular

good in a particular market within a market or mixed economic system.

It should be mentioned that at present the convergence of the concepts of „value“ and „cost“ is increasingly observed. This is due to the fact that the development of economic relations leads to the evaluation of an increasing number of value's factors. Nevertheless, the TEV includes both measurable indicators and indicators with an alternative form of evaluation. What is why it is more proper to utilize the term „total economic value concept“ instead of „total economic cost concept“ including the components of this concept as „values“. These „values“ have a cost that is evaluated in economic studies through an economic appraisal tool.

II. METHODS

It is practically impossible to find the references to the origins of the TEV in the scientific literature, but the first citation, in particular of the existence value, could be found in the research of B. Weisbrod [10] and J. Krutilla [11] dated the middle of the last century. As far as the TEV is concerned in general, the works of D. Pearce, J. Warford [12] and R. Turner [13] should be mentioned. In the book “Economics of natural resources and the environment”, 1990, D. Pearce and R. Turner noted two types of values: *instrumental and intrinsic*. According to D. Pearce and R. Turner, the *instrumental value* is identical to *use value*, while the *intrinsic value* is identical to *non-use value*. The total economic value is evaluated by the sum of *use value* and *non-use value*, whereas *use value* is equal to *actual use value* plus *option value*. *Non-use value* is equal to *existence value*. Thus, the formula for the TEV's components looks like this: $TEV = \text{actual use value} + \text{option value} + \text{existence value}$. In this book, D. Pearce and R. Turner understand the *option value* as the sum of *value in use by the individual*, *value in use by future individuals* and *value in use by others (vicarious value to the individual)*. *Option value* is willingness to pay for the conservation of natural resources and the environment for using it in the future. In more detail about the *option value* presented in the monograph by D. Pearce and R. Turner, could be read in research [14, 15]. In the “Economics of natural resources and the environment”, 1990, it follows that the *option value* is defined as a difference between the willingness to pay (option price that is above the market price) and the expected consumer surplus. The expected consumer surplus is equal to the relevant consumer surplus because “Since decisions are made on the basis of what is expected, we can say that the relevant consumer surplus is expected consumer surplus” [13, p. 132]. Willingness to pay (WTP) is the sum of market price and consumer surplus [13, p. 126]. As a result, *option value* is “extra payment to ensure future availability of the wildlife habitat” [13, p. 133]; it is like a payment for the risk.

In 1993 D. Pearce and J. Warford in the research “World Without End: Economics, Environment, and Sustainable Development” had other understanding of the TEV [12,14].

The *actual use value* is presented here as a sum of *direct value*, *indirect value* and *option value*. *Direct value* covers the resource function of natural capital. *Indirect value* corresponds to the ecological concepts regarding the value of ecosystem functions and services. *Option value* here is the amount that individuals are willing to pay in order to conserve natural

resources for their future use. The *option value* in this case resembles an insurance premium for provision of a resource or service which availability in the future is an uncertain quantity. *Option value* is not necessarily positive, as the preferences of future generations and the availability of natural resources in the long term are not exactly known. The term of *option value* was firstly introduced by B. Weisbrod [10] in 1964. According to B. Weisbrod, the *option value* is a price that people are willing to pay for preserving the resource with for its possible use in the future. B. Weisbrod offered to summarize the *option value* with expected benefits from various alternatives.

Quasi-option value, which was repeatedly mentioned in the literature [16,17], is the value of information that arises after making choice: to conserve or to develop the resource. For instance, society faces a choice that could be made in favor of both conservation and the development of natural resources. If the society chooses conservation, then in the future it will also have two options for deciding on this resource. If the society chooses the development, there is only one option in the future - to use the natural resource further because of irreversible changes of the ecosystem. In between the two periods information may arise that enhances the value of preservation, such as a scientific discovery about the flora and fauna. “*Quasi-option value* is the value of learning about the future benefits that would be precluded if development were chosen now” [12, p. 100]. *Quasi-option value* can be either positive or negative.

Existence value relates to valuations of the environmental asset that are unrelated either to current or to optional use. Its intuitive basis is easy to understand because a great quantity of people are willing to pay for the existence of environmental assets through wildlife and other environmental charities. D. Pearce and J. Warford offer the empirical measures of *existence value*, obtained through questionnaires (the contingent valuation method).

If the scientific community is in agreement about the sense of *direct value* and *indirect value* (*direct value* is evaluation of the resource function of natural capital, provisioning ecosystem services; *indirect value* is evaluation of regulating ecosystem services), *option value* as well as *intrinsic value*, *existence value* and *inherent value* are the basis for modern scientific debate. *Intrinsic value* of natural resources represents both moral aspects and benefits for nature itself. This two-faced nature of *intrinsic value* is the basis for endless disputes of the followers of Ethics (*intrinsic value* is identified with moral status) and Consequentialism (*intrinsic value* is the welfare of nature itself, its benefits for itself). As a result, *intrinsic value* can not be monetized according to both followers of Ethics and followers of Consequentialism, although in some research “*intrinsic value* lies in the good or well-being of all living entities” [18, p. 172] and these nature's advantages can be compared to the benefits that make up human well-being.

In practice there have been attempts to evaluate *intrinsic value* by the society's willingness to pay, i.e., that willingness to pay would be the amount that must be taken away from a person's income to keep his own well-being constant [19,20,21,22]. Moreover, we can concluded that environmentalists and economists tend to combine

philosophical terms *inner value* and *inherent value* in their studies under the definition of *intrinsic value*.

The concept of *existence value* was first introduced by J. Krutilla in 1967 [11], who argued that people may value nature not only for its actual use or for having the option of using it in the future [10], but also for its mere existence. J. Krutilla distinguished such value from *bequest value*, “an interest in preserving an option for one's heirs to view or use the object in question” [11, p. 781]. U. Pascual et al. [23] and R. Turner [24, p. 21; 25] define *existence value* as the satisfaction originating in altruism towards biodiversity. Other authors have equated the concept of *existence value* with the satisfaction originating in all three objects of altruism, i.e., towards one's contemporaries, future generations or nature [26]. R. Perman et al. equate *existence value* with any *non-use value*, i.e., any benefit arising “from knowledge that the service exists and will continue to exist, independently of any actual or prospective use by the individual” [21, p. 402]. Some authors define *existence value* as a person's willingness to pay to preserve a resource for which he has no current or future plans for use [27,28,29]. J. Aldred, on the other hand, defines *existence value* as “the value assigned by the agent to the good in addition to any expected changes in the welfare of the agent dependent on the good's continued existence” [30, p. 394]. This definition exactly excludes *non-use value*, but takes *existence value* as synonymous with the concept of *intrinsic value* and people's willingness to pay for benefits to nature [31]. The greatest interest of the sense of *existence value* is presented in the study [18], where M. Davidson defines *existence value* as “the satisfaction of knowing that nature exists but not originating in altruism” [18, p. 174]. It is interesting to note that M. Davidson also introduces into the TEV system *warm glow value* consisting of three components, i.e., values towards one's contemporaries, future generations and nature. “*Warm glow value* is the satisfaction of knowing that future generations, other people or nature benefit” [18, p. 174]. Adapted the TEV of the U. Pascual et al. according to M. Davidson is presented in researches [18,14].

III. RESULTS AND DISCUSSION

Considering the historical analysis of value's definition [15], as well as the development of the TEV and the theory of ecosystem services [3], we propose our own structure of the TEV (Fig.3).

This structure is based on the fact that value in its subjective understanding could be manifested as benefits for both human and nature, which consists of:

1) *Intrinsic value* is a subjective, non-derivative evaluation of the value of something attributed to itself, or inaccessible transcendental or distinctive value [32,33], or the value attributed to the moral aspects. Since the *intrinsic value* is tied to the subject of evaluation, and sometimes it is a moral aspect, scientists agree that it can not be monetized [34,35,36].

2) *Inherent value* is some usefulness, directly provided by the object of evaluation (opposite to the moral and physical aspects that have *intrinsic value*). *Inherent value* embodies supporting ecosystem services, thus most scientists intuitively realized that this type of services is methodologically incorrect to monetize [37, 38], but argued this with the reason of double

counting the supporting ecosystem services into regulating ecosystem services.

Instrumental value is the value of the object for achieving some goals, the functional perception of the object, which, in turn, is identified with **value of exchange** and **consumer value**. *Instrumental value* is traditionally divided into *use value* and *non-use value* in the practice. As it is accepted by the scientific community, we understand the economic sense of *direct value* as the evaluation of the resource function of natural capital (evaluation the direct use value of mineral, land, water and biological resources); *indirect value* is the evaluation of regulating and cultural ecosystem services. We include cultural services into *indirect value* because according with the methodological principle of dividing the value of use and non-use the inclusion of cultural services into *existence value* is inaccurate. The society uses natural resources for its own aesthetic, educational or recreational satisfaction. The scientific community is simply confused by the fact that after using natural resources from the point of view of cultural services there is no tangible result. It only manifests itself indirectly, as, in fact, regulating services, the benefits of which society receives, firstly, not purposefully on some area of distribution, and secondly, only after some period of time. With regard to *option value*, we agree with D. Pearce and R. Turner, that it is the society's preference, willingness to pay for the conservation of natural resources and the environment for the purpose of using it in the future, which consists of the sum of *value in use by the individual*, *value in use by future individuals* and *value in use by others (vicarious value to the individual)*. Since D. Pearce and R. Turner understood *value in use by others (vicarious value to the individual)* as the services' value provided by nature, we stands for the fact that *option value* should take into account only *value in use by the individual* and *value in use by future individuals*. At the same time, it is not entirely correct to utilize "sum of values" as presented by D. Pearce and R. Turner, because the *option value* mathematically is defined as a difference between the **willingness to pay with correction for risk and uncertainty about the future of ecosystems' natural resources and current willingness of society to pay for the conservation of these ecosystems and their natural resources**. We accept the hypothesis of varying *option value* in the range $(-\infty; +\infty)$. In other words, following the reasoning of D. Pearce and R. Turner we agree with the definition of *option value* as a risk payment calculated by the difference in the society's willingness to pay with and without correction for risk or difference between option price that is above the market price $((WTP-Market\ price)$, and the expected consumer surplus (Fig.1). Expected consumer surplus is equal to the relevant consumer surplus because “decisions are made on the basis of what is expected, we can say that the relevant consumer surplus is expected consumer surplus” [13, p. 132]. It should be mentioned that *value in use by future individuals* is accounted in *option value*. The question is to determine the significance of the risk and uncertainty about the future demand and supply of natural resources, because it has an influence on the society's willingness to pay for natural resources with correction for risk, which has a variation range $[0; +\infty)$. The sign of *option value* will be determined based on the conditions presented in Table 1. Interesting fact that

evaluation of "willingness to pay", which is in fact an economic calculation of *existence value* multiplied on the population of the analyzed territory, differ significantly in world practice depending on the income level of the population and their environmental awareness, which are due to the level of economic development of different countries. "So, if in developed countries the population is willing to pay for the existence of natural complexes nearly \$10-50 for a person per year, in other countries the population is ready to pay not more than \$ 1 for a person per year. According to Russian studies, the assessment of willingness to pay is about \$1 for a person per year. This figure is confirmed by a study conducted in Moscow to determine the willingness to pay for environmental protection (1999), as well as a study by A. Stetsenko (1999), conducted on the Kola Peninsula (Monchegorsk city)" [4, p. 204].

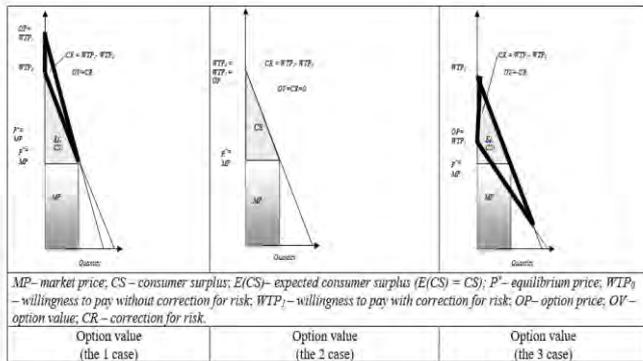


Fig. 1. Option value

TABLE I. OUR REPRESENTATION OF THE EVALUATION OF OPTION VALUE

Case	Conditions	Willingness to pay without correction for risk (WTP ₀)	Willingness to pay with correction for risk (WTP ₁)	Option value (OV) = correction for risk (CR)	Sign of Option value (OV)
1	WTP ₁ > WTP ₀	WTP ₀ × Q	WTP ₁ × Q	WTP ₁ - WTP ₀	+
2	WTP ₁ = WTP ₀	WTP ₀ × Q	WTP ₁ × Q	WTP ₁ - WTP ₀	0
3	WTP ₁ < WTP ₀	WTP ₀ × Q	WTP ₁ × Q	WTP ₁ - WTP ₀	-

Q – population of the analyzed territory, people.

1) *Quasi-option value* is the value of learning about the future benefits that would be precluded if development were chosen now. We do not accept the assumption of D. Pearce and J. Warford, who argue that *quasi-option value* is always positive [12]. The introduction of this value again into the TEV is due to the importance of the lost profits" institution in the Russian legislation (clause 2 of Article 15 of the Civil Code of the Russian Federation). The sign or trend of *quasi-option value* will depend on the utility and rarity of the ecosystems" natural resources if we rely on the marginal utility theory (Table 2).

TABLE II. OUR REPRESENTATION OF QUASI-OPTION VALUE

Future cases of ecosystem resources			
the 1 case	the 2 case	the 3 case	the 4 case
U↑R↑	U↑R↓	U↓R↑	U↓R↓
QOV↑	QOV = const or ↓		QOV↓

U – utility of the ecosystems" natural resources; R – rarity of the ecosystems" natural resources; QOV – quasi-option value.

The economic evaluation of the *quasi-option value* requires detailed and in-depth research. The only thing that is beyond doubt is that it will be the magnitude of the increase/decrease to *direct value* and *indirect value* plus all values associated with the conservation of the resource, which would be lost if development were chosen now.

2) *Non-use value* bases on *existence value*. As it was mentioned previously we agree that *existence value* is the satisfaction of knowing that nature exists but not originating in altruism [18] except the part "not originating in altruism". "Altruism" in dictionaries is an antonym to the word "egoism". Conservation of natural resources for others, including future generations and nature itself, is automatically an altruistic act. Therefore, M. Davidson's *warm glow value* only burdens the TEV. *Warm glow value's* components in our interpretation are taken into account in *option value* (the value of satisfaction from the knowledge that contemporaries and future generations are gaining (value in use by the individual, value in use by future individuals)) and in *existence value* (the value of satisfaction of knowing that nature is gaining benefits). As a result, *existence value* is the satisfaction of knowing that nature exists with reference to altruism in relation to nature itself, without the intention of any use of it.

Thus, a graphical model of all values, that bring benefits to a human and which are included in the structure of the TEV, (under the conditions of the first cases for *option value* and *quasi-option value* and developed market of ecosystem services), is shown in Fig. 2. *Quasi-option value* includes a significant part of other values, therefore for economic evaluation only the sum of AB and CD intervals should be calculated in order to avoid double counting.

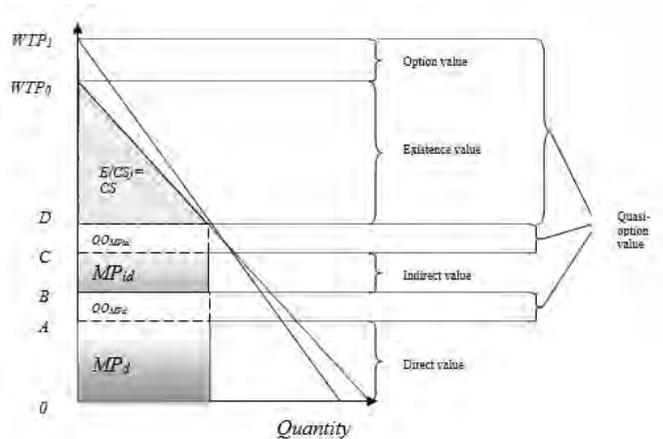


Fig. 2. Our graphic of the TEV

MPd – market price of ecosystems" natural resources (direct value); MPId – market price of ecosystem services (indirect value); CS – consumer surplus; E(CS) – expected

consumer surplus ($E(CS) = CS$); WTP0 – willingness to pay without correction for risk; WTP1 – willingness to pay with correction for risk; QOMPid – future financial increase from selling ecosystems’ natural resources if development were

chosen now; QOMPid – future financial increase from selling ecosystem services if conservation were chosen now.

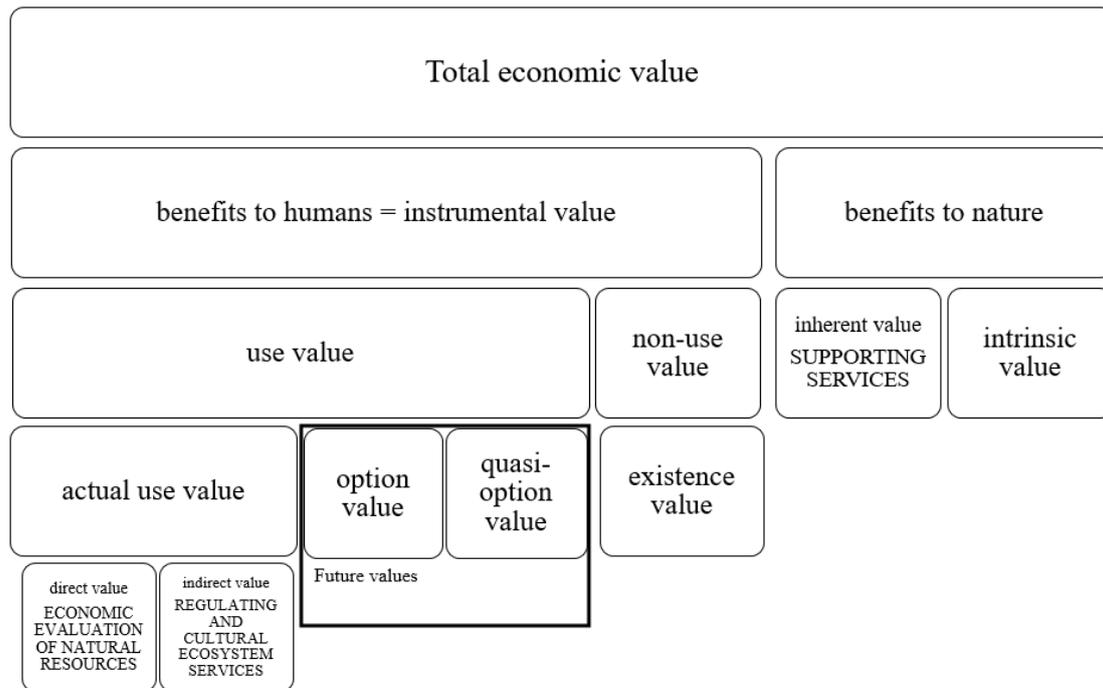


Fig. 3 Our structure of the TEV

Economic evaluation of ecosystems’ natural resources should take into account both current values and future values. This is necessary for increasing the effectiveness of state regulation of natural resource management, which is based on an economic appraisal tool employing to evaluate available natural resources. The quality economic appraisal tool ultimately affects the magnitude and mechanisms of the added value distribution obtained from the involvement of ecosystems’ natural resources in economic turnover both directly and indirectly. Thus, it is possible to evaluate the value of ecosystems’ natural resources in two ways: 1) to evaluate the value of ecosystems’ natural resources for the current generation and 2) to evaluate the value of ecosystems’ natural resources for the current and future generations. The interesting fact that values in relation to different natural resources are highly specific. For instance, mineral resources can only provide provisioning services and in some cases – cultural services. Mineral resources could be the source of cultural ecosystem services if the object, where the estimated mineral resources were located, was: firstly, a natural object under special protection or an object of cultural heritage according to law; secondly, offered to convert into natural object under special protection or an object of cultural heritage by the scientific community. All other resources could be employed directly or indirectly simultaneously whether water, land or biological. Even forest flora (if humanity does not consider a scenario of its complete destruction) could be utilized for obtaining wood, by thinning, i.e., intelligent felling of trees (which in fact is recognized by forest industry specialists as a synonym for reforestation, since it prevents the

risk of fires in summer periods), and, for instance, as a recreation object. Therefore, we can derive value from both direct use and indirect use. However, there are lots of direct use alternatives of natural resources, and the summation of all alternatives, as proposed by domestic and foreign researchers, disproportionately increases *direct use value*. Furthermore, we can choose only one possible option in reality for direct use. For example, either we could obtain the maximum amount of timber (residues for firewood) or we can use the whole wood for firewood from birch, pine, etc. There is no doubt that timber has a higher value than firewood. In this case, we propose to introduce the author's principle of value evaluation – “based on the best possible alternative”.

Thus, the formula of TEV is as follows:

$$\begin{aligned}
 \text{TEV} &= \text{benefits to human} + \text{benefits to nature} \\
 \text{Benefits to human} &= \text{use value} + \text{non-use value} \\
 \text{Benefits to nature} &= \text{inherent value} + \text{intrinsic value} \\
 \text{Non-use value} &= \text{existence value} \\
 &\textit{The first way} \\
 \text{Use value} &= \max(\text{direct value}) + \text{indirect value} \\
 &\textit{The second way} \\
 \text{Use value} &= \max(\text{direct value}) + \text{indirect value} + \text{option value} + \text{quasi-option value}
 \end{aligned}$$

The obtained author's formula of the TEV was tested on the natural resource potential of Berezovsky district of

Khanty-Mansiysk Autonomous District – Ugra (KhMAD) employing methodical tools for evaluating 1) *indirect value* [15] and 2) *direct value* [39, 40, 41]. As a result, the TEV of ecosystems’ natural resources of the KhMAD’s Berezovsky district (under the first case for *option value*) amounted to 73023.62 million rubles according to *the first way*, and 87327.59 according to *the second way*, which takes into

account future values, in 2016 (Table 3). *Direct use value* was five times lower than the *indirect use value*. This estimation could be useful for justifying the utilization of each tools of the economic mechanism of natural resource management as well as for developing an natural resource management’s strategy at all levels of governing.

TABLE III. TEV OF ECOSYSTEMS’ NATURAL RESOURCES OF THE KhMAD’S BEREZOVSKY DISTRICT (THE FIRST CASE FOR OPTION VALUE)

Indicators, thousand roubles		Natural resources					Total, thousand roubles
		Mineral resources	Land resources	Water resources	Biological resources	The whole ecosystem	
Use value	Direct value	11243921.00	33.45	740733.33	622192.32	-	12606880.10
	Indirect value	0.00	10335268.91	314194.17	50393195.63	246219.54	61288878.25
	Option value (the first case)	48187.50	48187.50	48187.50	48187.50	-	192750.00
	Quasi-option value	3694.38	2380806.22	75959.03	11594129.37	56630.49	14111219.50
Non-use value	Existence value	16062.50	16062.50	16062.50	16062.50	-	64250.00
TEV of ecosystems’ natural resources (<i>the first way</i>)		11259983.50	10351364.86	756795.83	50409258.13	246219.54	73023621.87
TEV of ecosystems’ natural resources (<i>the first way</i>), %		15.42%	14.18%	1.04%	69.03%	0.34%	100.00%
TEV of ecosystems’ natural resources (<i>the second way</i>)		11311865.37	12780358.58	880942.37	62051575.00	302850.04	87327591.36
TEV of ecosystems’ natural resources (<i>the second way</i>), %		12.95%	14.63%	1.01%	71.06%	0.35%	100.00%

Acknowledgment

The article is prepared in accordance with the scientific plan of The Ural State Mining University and state plan of Federal Agency for Scientific Organizations for the Institute of Economics, the Ural Branch of the Russian Academy of Sciences.

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