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Non-economic Characteristics for the Accounting in Projects' Appraisal

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Abstract:

The work presents the study of existing methods for accounting of non-economic parameters and indicators for the evaluation of projects in the world practice. The research method involves the collection and analysis of various aspects of this issue for the period from 1975 to March 2018 based on the Web of Science database.

Based on 57 sources conducted research, there were revealed advantages and disadvantages of the existing methods of approaches, a group of non-economic evaluation criteria was identified, a technology for assessing existing approaches and a trend of integrated evaluation of projects were taken into account during the process of accounting for non-economic and economic indicators.

The present work proposes a concept of a compromise assessment of projects in solving the set problem, which would combine the advantages of existing approaches and methods of world practice in impact assessment and project appraisal.

Keywords: *Non-economic characteristics; assessment of efficiency; impact assessment; project appraisal; sustainability.*

JEL Classification*: O22, O33.*

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1. Introduction

The problem of assessing the effectiveness and feasibility of investment projects that affect other important life-support systems except the economy (for example, ecology, public health, social responsibility, safety of activities: resource, scientific and technical, military-political security, the culture of the nation, the reputation of the country or region; antiterrorist activity, etc.) is becoming increasingly actual in the modern world. In this paper, we study the problem of non-economic characteristics accounting (indicators, parameters) in assessing the feasibility and financial viability of investment projects in general.

The object of our research are the articles that reflect ways and methods for assessing the effectiveness and impact of global projects (world-class projects), government projects (projects of national, national economic significance), large-scale projects (projects of industry-wide significance) indexed in the Web Science database.

We have uncovered the strengths, weaknesses, possibilities and threats of all kinds of impact assessment and project appraisal, on the basis of research conducted we highlighted the structure of groups of non-economic evaluation criteria with the frequency of application in the world practice, the tendency of an integrated approach to assessing the feasibility and effectiveness projects is revealed, we give some recommendations, which can help to improve the process of assessing the effectiveness of projects in terms of non-economic characteristics accounting and appraisal of the impact on the external environment of the project: ecology, health, social consequences, sustainability of development.

The recommendations are based on the application of a compromise approach in the form of a single quantitative integrated evaluation of the project's effectiveness, based on the method of aggregation theory, the Harrington desirability function.

2. Methods

The research was carried out by searching and analyzing of sources (articles, conference materials, etc.) on the subject of research in the database Web of Science Core Collection for the period from 1975 to March 2018. As it was discussed earlier, 168 search sources were selected for search queries. The study of these sources on abstracts allowed the selection of 60 cases reflecting the subject of the study. After a careful study of the original sources, 57 cases remain, which directly reflect the accounting of non-economic characteristics in the evaluation of various investment projects, i.e. subject of research. Below are the key phrases with the words that were searched and the search results (Table 1).

Table 1. *Types of search phrases and the number of sources received for research from Web of Science Core Collection database*

№№	English (Google Translator), Web of Science Core Collection	The number of potential sources for analysis (without considering inappropriate to the subject of research)
1.	"social effective* evaluation"	1
2.	non-econom* and "effectiven* evaluation"	1
3.	"non$economic*" "investment project*"	1 (2-1=1)
4.	"non-economic external*"	1
5.	"non-economic param*"	3 (5-2=3)
6.	"non-economic characterist*"	1 (7-6=1)
7.	"social effective* assessment"	0
8.	"assessment social effective*"	0
9.	"investment projects of national economic level"	0
10.	"ecological efficiency evaluation"	2
11.	"world-class investment projects"	0
12.	"investment projects world-class"	0
13.	world-class and "invest* project*"	0
14.	"world-class" and "invest* project*"	0
15.	"invest* project*" and "national econo*"	18 (27-9=18)
16.	"eco-oriented" and "invest* project*"	1
17.	"invest* project*" and "global econo*"	1 (9-8=1)
18.	"invest* project*" and "social effectiv*"	0
19.	"invest* project*" and "public effectiv*"	0
20.	non$economic external*	2 (15-13=2)
21.	"invest* project*" and "world econo*"	4 (7-3=4)
22.	"government invest* project*" and "effectiven* evaluation"	0
23.	"government invest* project*" and "effectiven*"	1 (2-1=1)
24.	"public invest* project*" and "effectiven* evaluation"	1
25.	"public invest* project*" and "effectiv*" (11-6=5)	5 (11-6=5)
26.	"Large-Scale Projects*" and "effective* evaluation"	1
27.	"Large-Scale Projects*" and "effective* assess*"	0
28.	"Large-Scale Project*" and "effectiven* evaluation"	1
29.	"Large-Scale Project*" and "assessment of efficien*"	0
30.	"invest* project*" and "assessment of efficien*"	0
31.	"Large-Scale Project*" and "efficiency*"	4 (55-51=4)
32.	"Project Appraisal" and "Impact Assess*"	11 (19-8=11)
33.	Total	60 (168-108)

3. Research and Results

Thus, the research of the literature source indexed in the Web of Science Core Collection database on the stated problems makes it possible to single out the following structure of non-economic parameters, indicators, characteristics, according to which the projects are evaluated in the world practice (Table 2):

Table 2. *Identified groups of non-economic characteristics taken into account in the evaluation of investment projects (IP) in the world practice*

№№	Group of non-economic characteristics (parameters, criteria)	Analyzed sources of literature that reflect the criteria	Cases in total	Percentage, %
1	Ecological and social criteria for assessing IP	(Cashmore and Morgan, 2014; Haigh et al., 2013; Morgan, 2012), (Bice and Moffat, 2014), (Burdge, 2003; Esteves et al., 2012; Joseph et al., 2015),(Noble et al., 2012; Polido and Ramos, 2015), (Abbasi et al., 2011; Bisset, 1981; Gilvear, 1999; Hua et al., 2007; Li and Ding, 2017; Liu et al., 2016; Morrissey et al., 2012; Shkarupa and Burych, 2015; Tyazhkorob, 2015; C. M. Wang and Liu, 2009), (Ahrens et al., 2015; Mirumachi and Torriti, 2012; Novackova et al., 2016; Ponomarenko et al., 2016)	23	38
2	Criteria for sustainability of the development of a region, a state	(Laedre et al., 2015), (Bond et al., 2012; Costanza, 2006; Maack and Davidsdottir, 2015), (Morrissey et al., 2012), (Barton and Grant, 2008; Cehlar et al., 2014; Perrings and Stern, 2000; Senner, 2011), (Bai et al., 2012; Shiferaw and Klakegg, 2013; Shiferaw et al., 2012; Wu et al., 2013)	13	22
3	Criteria for assessing the risk of IP	(Liang et al., 2017; Platon et al., 2014),(Gilvear, 1999),(Jac, 2012; Xu et al., 2017; Yao and Wang, 2008)	6	10
4	Other criteria for assessing IP (energy security, project implementation time, complex criteria)	(Huging et al., 2014; Mendecka and Koziol, 2015; Viturka, 2014),(Romanelli and Milan, 2010),(Chen et al., 2009; Pan and He, 2009),(Boctor, 1990; Jackson, 1991; Metcalf, 2014)	9	15
5	Economic criteria for assessing IP (assessment of benefits and costs)	(Jones et al., 2014; Korytarova and Hromadka, 2014; Korytarova and Papezikova, 2015),(Droj and Droj, 2015),(Joseph et al., 2015),(Griskeviciute-Geciene and Lazauskaite, 2011; Selle and Zimmermann, 2003; J. H. Wang and Ji, 2012; Yeleukulova et al., 2012)	9	15
6	**Cases in total**		**60**	**100**

There is identified established consistency in technology for assessing the effectiveness and feasibility of projects: a) projects are initially evaluated by stakeholders in the implementation of the project (decision makers, customers,

investors) based on the economic benefits of the project (on economic evaluation criteria); b) afterwards, there comes an assessment of the third parties impact (impact assessment experts, supervisory authorities, community representatives); c) the method of finding a compromise is carried out as the leading one in the coordination of evaluations of those and other persons (changes in restrictions on the necessary and important conditions of the project; making adjustments to the structure and content of the project; qualitative change in the essence of the project; rejection of the project).

The analysis showed the existence of similar existing approaches in the assessment. For example, an environmental impact assessment and an assessment of the sustainability impact correlate with each other, complementing or replacing each other. We propose the alternative concept for evaluating the efficiency and feasibility of projects – the concept of a compromise assessment of projects that will allow us to change the existing valuation technology. It is based on the definition of an integral criterion for project evaluation in a dimensionless scale. The concept allows to develop a methodology that will consider the desires of both interested parties and the limitations of third parties when evaluating the project. Priority is given to non-economic indicators (that is, limitations of impact assessment experts), and only then the project receives the evaluation of effectiveness on its economic indicators (NPV, IRR, PI, etc.)

The essence of the methodology is that it allows quantifying the assessments of experts on impact assessment in the overall integrated assessment. To do this, you need to set constraints and (or) desirable levels for all the estimated parameters. All scores of qualitative parameters and all possible measurements of quantitative parameters can be converted into a single dimensionless scale, for example, the Harrington desirability function. This approach to evaluation was developed by us for the problem of evaluating the effectiveness of investment projects in engineering (A. S. Puryaev, 2009; Aidar S. Puryaev, 2015) and, from our point of view, it will be relevant and in demand in assessing the impact and evaluation of projects.

Below we outline the mathematical apparatus (the Harrington desirability function method), which we apply in solving the problem of evaluating the effectiveness and feasibility of projects (Harrington, 1965):

$$d = e^{-e^{-y'}} \tag{1}$$

$$y_i' = \frac{y_{max} - y_i}{y_{max}} \tag{2}$$

$$y_i' = \frac{y_i - y_{min}}{y_{min}} \tag{3}$$

where d_{ij} is a desirability function with one-sided constraint for the i-parameter of the estimation of the j-project;
y_{ij} is the value of the estimated i-parameter of the j-project in its units of measurement;
y_{max}, y_{min} – the upper and lower limits of the unilateral constraint on the i-parameter of the j-project evaluation;
y'_i – coded (normalized) value of the i-parameter of the j-project, transformed into the desirability scale.

The generalized Harrington desirability function (the selection criterion) of the j-project (D_j) is defined as the average geometric mean of the partial desirabilities by the formula:

$$D = \sqrt[n]{d_1 \times d_2 \times d_3 \times \cdots \times d_i \times \cdots \times d_n} \quad (4)$$

That project, in which the value of D_j has a greater significance among the alternatives, is optimal (effective) for a whole complex of parameters of different physical nature (ecological, social, economic, scientific and technical safety parameters, resource security and all the other necessary for the impact assessment).

For translating the evaluation parameters presented in the form of linguistic variables (fuzzy sets) into the desirability scale, we have developed a mechanism for translating the values of the membership function into the values of the desirability function (Puryaev, 2015).

4. Conclusion

So, the research showed:

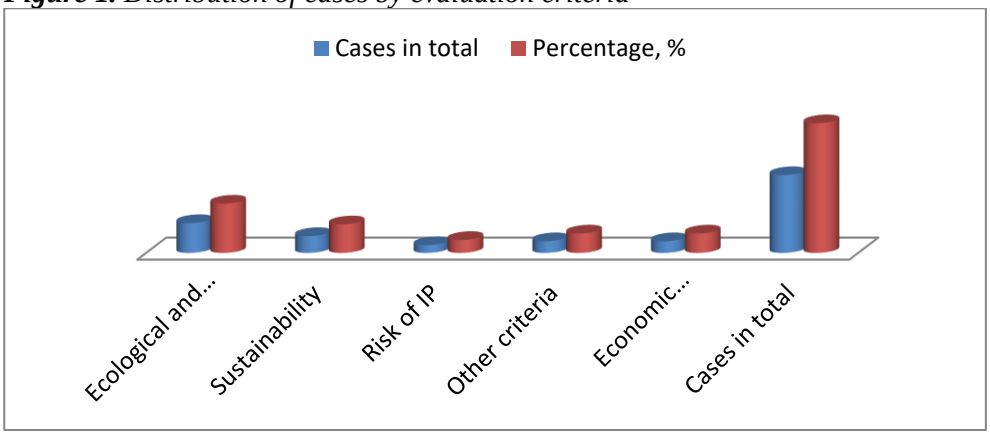
1. Out of the sixty cases of investment project evaluation, considering non-economic parameters, 9 cases (15%) were identified only by economic criteria. This applies, first, to projects global, national and large-scale. Among the remaining projects under study, a significant proportion is occupied by projects evaluated according to environmental and social parameters (criteria) – 23 cases (38%) and stability criteria 13 cases (22%), which together constitute 36 cases (60%). It is appropriate to speak about this association, since it is established that the criterion of sustainability reflects the ecological, social and economic parameters taken together. Directly, the risk score is evaluated in six cases out of 60 (10%).

2. In nine cases out of sixty (15%), the project is evaluated against other non-economic criteria, seven of which are complex, considering various physical parameters that have been translated into universal (normalized) scales. Such a compromise approach is particularly relevant. It allows to consider the influence of various parameters on the physical essence when assessing the feasibility and

efficiency of the project. In 12% of cases, this trend is reflected and is a good signal for additional research in this direction. This is what we are working on now.

If we adopt a concept based on a compromise, comprehensive consideration of parameters of the non-economic and economic nature, as a methodology for evaluating projects and their impact at the official level, this would eliminate many contradictions and combine the advantages of different approaches and methods: Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), Sustainability Impact Assessment (SIA), Social Impact Assessment (SIA), Health Impact Assessments (HIA), Environmental, Social and Health Impact Assessments (ESHIA), Regulatory Impact Assessments (RIA), Cultural Impact Assessments (CIA), Human Rights Impact Assessments (HRIA), Social Licence to Operate (SLO), Strategic Project Appraisal (SPA), Reference Class Forecasting (RCF), Cost-Benefit Analysis (CBA) and others. There are resulting diagrams of undertaken research on Figure 1.

Figure 1. *Distribution of cases by evaluation criteria*



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