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THE SYSTEM OF INDICATORS FOR THE ECONOMIC EVALUATION OF DIRECT TECHNOGENIC DAMAGE CAPACITY IN THE NATIONAL ECONOMY

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The system of indicators for the economic evaluation of technogenic (man-made) losses of economic activity has been investigated. The method of calculation of indicators of technogenic damage-capacities has been proposed. Recommended structure of direct technogenic damage-capacities is including the next components: resource- (specific consumption of material resources), fuel- (specific consumption of fuel resources), energy- (specific electricity consumption), water- (specific water consumption), land- (specific land use for manufacturing), waste- (specific waste generation), emission- (specific emissions generation), contaminated water discharge- (specific contaminated water discharge generation), general damage-capacities (specific technogenic losses associated with the loss and outgoings of natural and financial resources or to shortfalls in the future) and more. The output has been analyzed by the basic indicators of technogenic damage-capacity.

Keywords: *technogenic (man-made) losses, the national economy, economic evaluation, indicator system, technogenic damage capacity.*

Introduction. The rapid development of the scientific and technological progress increases the demands to the management of the national economy, which will result in the need to solve problems is the rational management of natural resources, environmental activities and determine their economic efficiency at the national (macro) level. Solving these problems involves not only reduction of environmental impact, but also creation of a favorable environment for greening

production and implementation of green economy policies. National economy of Ukraine requires a holistic way of forming the economic mechanism aimed at developing complex of low-waste technologies and high-tech economy. Of particular relevance there is the problem of economic evaluation at the macro level of damage caused by pollution, deterioration of health, increased mortality, etc., described the concept of technogenic (man-made) losses into the national economy.

Analysis of recent researches and publications. Theoretical aspects of economic evaluation in the management of the national economy researched in the papers of domestic and foreign scholars. In particular in the area of the losses economy, economic evaluation studied by scientists and researchers from all over the world, including the significant contribution made by Ukrainian scientists: O. Balatskyy [1], L. Melnyk [2], Ye. Mishenin [3], Yu. Tunytsya [4], etc. Recently there has been formed Lviv economic research under the guidance of prof. Kuzmin O. [5] whose achievement are related with solution of the problems of economic evaluation of man-made losses in the national economy and state regulation.

Previously unsettled problem constituent. Our studies show that in Ukraine remains the immature indicator system of economic evaluation of man-made losses in the national economy and unresolved issues of completeness and objectivity of the existing profile parameters on the prediction of increasing the destructive impact of economic activity on the environment and society.

Main purpose of the article. The theoretical foundations and applied problems of an economic assessment of losses in the national economy determines the setting of the following objectives:

1) to substantiate the theoretical bases of formation of man-made losses in the national economy;

2) to propose a indicator system for economic evaluation of direct technogenic damage-capacity and method of their calculation;

3) to analyze the output of goods and services for each economic activity (EA) be the indicators of direct technogenic damage-capacity (resource, fuel, energy, water damage-capacities, etc).

Results and discussions. The source of the formation of man-made damage into the national economy is manufacturing, transport and the provision of some services related to the collection and storage of waste, electricity, gas, steam and conditioned air, etc. The consequences of human activities is the loss of non-renewable natural resources, significant degradation of renewable resources, the accumulation of hazardous waste and the resulting decline in the quality of human resources, including their loss. The research of relationship of the output of goods and services for each EA with expenses and losses caused by the output was conducted within the national economy according to the State Statistics Service of Ukraine [6, 7]. Many researchers in [8–10] used for economic evaluation of resources losses or expenses

the specific indicators: resource, fuel, energy, water damage-capacities and others.

Based on the analysis of the known research results [1–10], we propose a common indicator system for economic evaluation of man-made loss supplemented by special indicators. These indicators characterize the use of resources (material, energy, natural, human, etc.) during the production of goods and services and their specific losses in the national economy in financial form. The proposed indicators can be grouped into two types: direct and indirect damage-capacities. Our recommended structure of direct technogenic damage-capacities is including the next components: resource damage-capacities (specific consumption of material resources), fuel damage-capacities (specific consumption of fuel resources), energy damage-capacities (specific electricity consumption), water damage-capacities (specific water consumption), land damage-capacities (specific land use for manufacturing), waste damage-capacities (specific waste generation), emission damage-capacities (specific emissions generation), discharge damage-capacities (specific discharges generation), general damage-capacities (sector specific losses associated with the loss and costs of material and financial resources or to shortfalls) and more. The method of calculation of basic indicators of direct technogenic damage-capacities in the national economy and the substance of the parameters is shown in the next formulas (1) – (5).

$$ResC = Res / GDP, \quad (1)$$
$$FueC = Fue / GDP, \quad (2)$$
$$EneC = Ene / GDP, \quad (3)$$
$$WatC = Wat / GDP, \quad (4)$$
$$GLoC = GLo / GDP, \quad (5)$$

where ResC – specific consumption of material resource (by type) per unit cost of output goods and services in national economy, measured in relative units, r.u., (UAH to 1 UAH production of GDP);

Res – the cost of using a particular type of material resource for the production process (thous. UAH);

FueC – specific fuel consumption per unit cost of output (r.u.);

Fue – cost of fuel resources for the production process (thous. UAH);

EneC – specific consumption electricity per unit cost of output (r.u.);

Ene – cost of energy use for the production process (thous. UAH);

WatC – specific consumption of services for water and wastewater per unit cost of output (r.u.);

Wat – cost of services of water supply and sewage consumed in the manufacture and production (thous. UAH);

GloC – specific general direct losses in the national economy due to loss of resources (natural, material, fuel, energy, raw materials, etc.) per unit cost of GDP (in cost spending at intermediate consumption), (r.u.);

Glo – general direct loss of resources due to production (in cost on intermediate consumption) (thous. UAH);

GDP – amount of gross domestic product (thous. UAH).

The analysis of output in goods and services for every EA (by the NACE Codes) was conducted by the method of calculation of indicators of direct technogenic damage-capacity. Data are taken from data base published by the State statistics services of Ukraine [6]. The processes of reproduction in the national economy have been described by the 'input – output' matrix in the cost form for each EA in accordance with the current classification of the EA (NACE-2010) [6, p. 43–49]. The 'input – output' matrix in the first quadrant (consumption) in columns displays the cost structure of the gross output of goods and services for each EA in the structure of expenses for certain species of products and services which are used in the production process [6, p. 6–29]. Due to the formulas given in (1) – (5), it has been calculated the composition of gross output of each EA according to the structure of consumption of resources (specific general direct damage-capacity) that are consumed in the production of goods and services (Table 1). The total (general) specific direct damage-capacities of gross output of agriculture, forestry and fishery farms is 0,54 UAH to 1 UAH of output production (Table 1).

Table 1. **The structure of specific direct damage-capacities of gross output for each EA in 2012, in UAH. to 1 UAH. of output ***

NACE Code of EA	Name of EA	The specific direct damage-capacities			
		General	Fuel – energic	Water and wastewater	Material resource
A**	Agriculture, forestry and fishery	0,5373	0,0128	0,0017	0,5227
B	Mining and quarrying	0,4316	0,1051	0,0031	0,3233
C	Manufacturing	0,7377	0,0447	0,0050	0,6880
D	Electricity, gas and water	0,6216	0,0516	0,0100	0,5600
E	Water supply; sewerage, waste management	0,6545	0,1882	0,1132	0,3531
F	Construction	0,7095	0,0058	0,0056	0,6981
G	Wholesale trade, vehicles and motorcycles	0,4390	0,0136	0,0011	0,4242
H	Transportation, warehousing, postal and courier activities	0,4860	0,0568	0,0027	0,4265
I	Temporary placement and organization of catering	0,4933	0,0391	0,0074	0,4468
J	Information and telecommunications	0,5007	0,0190	0,0003	0,4814
K	Financial and insurance activities	0,3750	0,0009	0,0002	0,3738
L	Real estate activities	0,2923	0,0678	0,0092	0,2153
M	Professional, scientific and technical activities	0,4898	0,0083	0,0013	0,4802
N	Activities in administrative and support services	0,4892	0,0304	0,0289	0,4299
O	Public administration and defense; compulsory social security	0,2327	0,0261	0,0058	0,2008
P	Education	0,2517	0,0597	0,0060	0,1860
Q	Health care and social assistance	0,2901	0,0387	0,0077	0,2437
R	Arts, sports, entertainment and recreation	0,4079	0,0385	0,0039	0,3656
S	Providing other services	0,2756	0,0209	0,0043	0,2503

* Author's approach; ** The letter indicated NACE Code of EA

The most specific general direct damage-capacities observed in 2012 year for the next EA: C – manufacturing (0,74 r.u.), D – electricity, gas, steam and air

conditioning (0,62 r.u.), E – water supply, sewerage, waste management (0,65 r.u.), F – construction (0,71 r.u.). The maximum cost of fuel and energy resources is in E – Water supply; sewerage, waste management (0,1882 r.u.), minimum costs is in K – Financial and insurance activities (0,0009 r.u.). Average cost of investigated resources are 0,0436 r.u. There are 12 EAs where the fuel-energic damage-capacity is below average value and 7 EAs where it is above average value. The same is true of the use of water supply, sewage and waste management. The damage-capacities of these resources is below the average value for the 17 EA and for 2 EA it is above. Table 2 shows the structure to using different types of energy resources for each EA of national economies in 2012 year.

Table 2. **Structure of fuel and energy resources by its type for each EA in 2012, in t. ***

Type of fuel	A	B	C	D	F	G	I	H	K	L	O	P	Q	R
Coal	62013	700164	30563184	40020832	14705	50312	3536	11621	305	13442	378454	108059	96793	4749
Coal and peat	3	6	3178	60	-	-	-	-	-	81	1976	458	392	-
Oil	-	115044	3783768	-	2641	667	-	-	-	-	-	-	-	-
Gas Condensate	113	121568	752215	438	-	-	-	121	-	-	-	-	-	-
Natural gas	589335	2036612	15644715	14212748	80723	187238	30987	2072221	9867	278202	402283	222661	213879	39643
Peat	-	390992	19502	1880	-	19	-	12	-	-	607	35	1775	-
Firewood for heatin.	18404	1228	277776	68492	5460	12556	2205	34258	133	12177	215215	133809	80523	15619
Coke of coal	-	153635	16135974	346	6	14	-	184	-	-	-	2	-	8
Gasoline engine	203318	39612	1535575	71469	54081	106935	3558	112018	17932	51861	54135	16067	46880	21325
Gas oil	1321638	391194	800768	57473	246722	256481	3071	1261460	9875	41234	16024	8231	9229	38851
Kerosene	69	3359	9707	194	224	793	-	306020		1798	1168	649	-	116
Oils heavy	1397	10769	166420	83620	10451	76	104	38677	18	3767	5631	210	3171	286
Propane&butane lq.	17885	1788	41429	21238	3212	24598	618	12928	77	2899	1390	555	2843	2725
Carbohydrates gases	4	1	271515	-	5	3	-	6	-	-	-	-	-	-
Vazeli, paraffin, mineral wax	-	3	1814	-	1	-	-	-	-	-	-	-	-	-
Briquette of fuels	2	18	990	244	-	-	7	3	-	-	834	27	399	-
Briquettes of peat	1558	2141	4334	2971	50	714	236	1094	23	365	45350	8678	8392	515
Bitumen. and shale	1076	18178	55680	606	185910	1		45295	-	25	-	1	1	427
Cox oils. and shale	-	9	35771	-	-	-	-	1	-	4	-	25	160	-
Oils and Fluids	25957	23744	165609	7302	4422	1215	9	24752	29	690	352	133	-	891
Oil waste	26	487	15933	228	14	3	-	1214	-	12	4	-	-	3
Motor oils	-	16	7348	-	4	-	-	20	-	4	-	-	-	-
Stone – coal gas	-	-	7386123	3467	4	-	-	-	-	-	-	-	-	-
Blast furnace gas	-	27809	41215154	-	-	-	-	-	-	-	-	-	-	-

* Author's calculated by source [7].

The largest volume of fuel and energy resources recorded in manufacturing and production and distribution of electricity, gas and water. The largest volume of fuel resources in the national economy is identified for natural gas and motor gasoline (table 2).

Consequently, the processing industry (C) is the most used fuel and energy resources. The resource use is 11889.45 thousand tons of conventional fuel that the percentage is 63.37%. The production and distribution of electricity, gas and water (D) consumes half the fuel and energy resources. The resource use is 54553.63 thousand. tons of conventional fuel that the percentage is 29.08% (Tabl.2). The financial and insurance activities (K) consumes the lowest fuel and energy resources, where consumption of these resources is 38.25 thousand tons of conventional fuel, as a percentage – about 0.02%.

Conclusions and further researches directions. So, the proposed method of calculating direct technogenic damage-capacity forms the methodological and information basis for economic evaluation of quantitative and qualitative analysis of the impact hazard to the environment and people, and to calculate indicators of technogenic damage-capacity as a whole national economy, and its economic activities. We also proved the theoretical aspects of the formation of man-made losses in the national economy and their quantitative (technogenic damage-capacity). It has been analyzed the output of goods and services by indicators of direct technogenic damage-capacity (specific resource, fuel, energy, water damage-capacities, etc).

The work on forecasting future technogenic damage-capacity should continue in the direction of application possibilities of fuzzy sets as modern mathematical tools to describe the phenomena of incomplete data and under uncertainty.

References

1. Balatskyi, O.F. (2007). Sumskaia nauchnaia shkola ekonomiki pryrodopolzovanyia [Sumy scientific school of economic natural resources using]. *Visnyk Sumskoho derzhavnoho universytetu. Seriia Ekonomika – Bulletin of Sumy state university, 1, Vol.2, 5-17.* [in Russian].

2. Melnyk, L.H., & Lukash, O.A. (Eds.). (2015). *Metody resheniia ekolohicheskikh problem. Tom 4. Ekolohicheskiie vyzovy i ekonomicheskiie vozmozhnosti [Methods of Ecological Problems Solving.* Vol. 4. Environmental Challenges and Economic Opportunities*.]*. (Vols. 1-7). Sumy: Sumy State University. [in Russian].

3. Mishenin, Ye.V., Yarova, I.Ye., & Mishenina H.A. (2009). Otsenka ekolohicheskikh izderzhek v lesopolzovanii kak instrument ustoichivoho razvitiia lesopromyshlennoho kompleksa [Ecologic evaluation of outgoings in forest management as tools of sustainable development of the forestry enterprises complex]. *Produktyvni syly Ukrainy: nauk.-teoret.-ekonomichnyi zhurnal – The productive forces of Ukraine, scientific-teoret. economic journa, 1 (004), 116 – 120.* [in Russian].

4. Tunytsia, Yu.Yu. (2012). Pro kontseptsiiu stymuliuvannia ekolohichno bezpechnoi ekonomiky [On the Concept stimulate environmentally sound economy]. *Visnyk Natsionalnoi Akademii Nauk Ukrainy – Bulletin of the National Academy of Sciences of Ukraine, 5, 26–30.* [in Ukrainian].

5. Kuzmin, O.Ye., & Bublyk, M.I. (2014). Derzhavne rehuliuvannia tekhnohennykh zbytkiv ta yoho otsiniuvannia v strukturi mekhanizmu stiikoho rozvytku ekonomichnykh system [State regulation of man-made damage and its evaluation in the structure of the mechanism of sustainable development of economic systems]. *Mechanismus der nachhaltigen entwicklung des wirtschafts systems formation – Mechanism of sustainable development of economic systems formation* (Vols. 1), (pp. 109 -114). Nurnberg, Deutschland: Verlag SWG imex GmbH [in Ukrainian].

6. Nikitina, I.M. (Eds.) (2014). *Tablytsia vytraty – vypusk Ukrainy za 2012 rik v osnovnykh tsinakh : statystychnyi zbirnyk [Table input – output of Ukraine for 2012 at basic prices: Statistical Yearbook]*. Kyiv: Derzhsluzhbastat Ukrainy [in Ukrainian].

7. Nikitina, I.M. (Eds.) (2014). *Palyvno-enerhetychni resursy Ukrainy za 2012 rik: statystychnyi zbirnyk [Fuel and energy resources of Ukraine in 2012: Statistical Yearbook]*. Kyiv: Derzhsluzhbastat Ukrainy [in Ukrainian].

8. Husieva, I.I., Derhachova, V.V., Karaieva, N.V., & Serebrennikov, B.S. (2010). *Modeliuvannia vplyvu intehratsiinykh rishen v enerhetytsi na peredumovy dosiahnennia staloho rozvytku terytorii [Modeling the impact of integration solutions in energy prerequisites for achieving sustainable development of the area]* N.V. Karaieva (Ed.). (299–310). Cherkasy : Vydavets Chabanenko Yu.A. [in Ukrainian].

9. Zharova, L.V., Kakutych, Ye.Yu., & Khlobystov, Ye.V. (2009) *Ekolohichne pidpryiemnytstvo ta ekolohizatsiia pidpryiemnytstva: teoriia, orhanizatsiia, upravlinnia [Environmental greening business and entrepreneurship: theory, organization, management]*. B.M. Danylyshyn (Ed.) – Sumy: VTD «Universytetska knyha» [in Ukrainian].

10. Andrieieva, N.M., Barannik, V.O., & Khlobystov Ye.V. (2010). *Stalyi rozvytok i ekolohichna bezpeka suspilstva v ekonomichnykh transformatsiiakh [Sustainable development and environmental security in the economic transformation of society]*. Simferopol: PP «Pidpryiemstvo «Fieniks» [in Ukrainian].

СИСТЕМА ПОКАЗНИКІВ ЕКОНОМІЧНОГО ОЦІНЮВАННЯ ПРЯМОЇ ТЕХНОГЕННОЇ ЗБИТКОЄМНОСТІ В НАЦІОНАЛЬНОМУ ГОСПОДАРСТВІ

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Досліджено систему показників економічного оцінювання техногенних (антропогенних) збитків для кожного виду економічної діяльності. Запропоновано метод розрахунку показників техногенної збиткоємності. Рекомендована структура прямої техногенної збиткоємності складається з таких компонентів: ресурсо- (питомі витрати матеріальних ресурсів), паливо- (питомі витрати паливно-енергетичних ресурсів), енерго- (питомі витрати електроенергії), водо- (питоме споживання води), земле- (питоме використання землі під виробництво), відходо- (питоме утворення відходів), викидо- (питоме утворення викидів), скидо- (питоме утворення скидів), загальна збиткоємність (питомі техногенні збитки, пов'язані із втратою та витратами природних і фінансових ресурсів або їх недоотриманням в майбутньому) і т.д. Проаналізовано випуск товарів і послуг за основними показниками техногенної збиткоємності.

Ключові слова: *техногенні (антропогенні) збитки, національне господарство, економічне оцінювання, система показників, техногенна збиткоємність.*

СИСТЕМА ПОКАЗАТЕЛЕЙ ЭКОНОМИЧЕСКОЙ ОЦЕНКИ ПРЯМОЙ ТЕХНОГЕННОЙ УЩЕРБОЕМКОСТИ В НАЦИОНАЛЬНОМ ХОЗЯЙСТВЕ

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Исследовано систему показателей экономической оценки техногенного (антропогенного) ущерба для видов экономической деятельности. Предложено метод расчета показателей техногенной ущербоемкостей. Рекомендуемая структура прямой техногенной ущербоемкости состоит из следующих компонентов: ресурсо- (удельный расход материальных ресурсов), топливо- (удельный расход топливно-энергетических ресурсов), энерго (удельный расход электроэнергии), водо- (удельный расход воды), земле- (удельное использование земли под производство), отходо- (удельное образование отходов), выбросо- (удельное образование выбросов), сбросо (удельное образование сбросов), общая ущербоемкость (удельный техногенный ущерб, связанный с потерей и расходами природных и финансовых ресурсов или их недополучением в будущем) и т.д. Проанализирован выпуск товаров и услуг по основным показателям техногенной ущербоемкости.

Ключевые слова: *техногенный (антропогенный) ущерб, национальное хозяйство, экономическая оценка, система показателей, техногенная ущербоемкость.*