

■ МАТЕМАТИЧНІ МЕТОДИ, МОДЕЛІ ТА ІНФОРМАЦІЙНІ  
ТЕХНОЛОГІЇ В ЕКОНОМІЦІ

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**SEE-ANALYSIS OF THE FORCE  
FOR PROCESS  
OF HANDLING WITH WASTES IN  
UKRAINE<sup>©</sup>**

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*The methods of analyzing the force for process of handling with wastes in Ukraine based on the author's components of efficiency are implemented. This technique is based on the SEE-analysis of complex systems, which is highlighted in previously published works in joint creative work with the author V. Yarmolenko. An integral part of this analysis is finding F-impulses of subprocesses of certain processes that take place in systems of different types. Such impulses are factors that contribute to the formation of products of the appropriate processes. The numerical values of these impulses is reduced in a matrix, which contains rates of tempo for increase of constituents of efficiency for process of handling with wastes in Ukraine and describes the degree of influence of certain factors on the formation of the products of this process. It was applied offered in previously published author's works and on specific examples confirmed position that SEE-analysis is an integral part of the SEE-control, by the results of which proposals formulated for this administration in the context of the National Strategy for management by wastes in Ukraine 2030.*

**Key words:** capital investment and current cost for process of handling with wastes; National Strategy for Management by Wastes in Ukraine until 2030; rates of scale product, effectiveness and efficiency of the process; F-impulses, SEE-analysis and SEE-management of process; models for components of efficiency of Burennikova (Polishchuk) - Yarmolenko.

**Tab.: 3. Lit.: 12.**

**Formulation of the problem.** As experience of the countries of Western Europe (Switzerland, Germany, Sweden, etc.) and the world shows, the management by wastes is an urgent problem. There is a five-tier hierarchy for process of handling with wastes in the European Union, the main priorities of which are prevention of waste utilization and implementation of waste-free industries. The aforementioned management should be based on a certain legislative framework, including in the field of waste management consideration of the requirements of European directives, requires the transition to an economy of closed cycle of production, requires appropriate logistics, etc. Effective

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logistics of management wastes, in turn, requires new approaches to understanding the processes that are occurred in management of wastes, and requires of innovative assessment of the results of these processes for the purpose of finding ways to improve the environmental situation in the country.

To date, as it is known, processes of clogging of Ukrainian lands have accelerated. Every year in the country more than 700 million metric tons of wastes are generated. Total area of lands, occupied by garbage, forms more of 160 thousand hectares. As noted by Nagirnyak T.B. "... according to estimations of economists-ecologists, annual losses of our state from irrational use of natural resources and total pollution of the environment reach 15-20% of its national income" [1]. For the purpose of defense of natural environment in Ukraine there are 29 directives and regulations covering a wide range of environmental problems that should be implemented in Ukraine over a period 2-10 years. The Resolution of the Cabinet of Ministers of Ukraine dated November 8, 2017 No. 820-r approved the National Strategy for Wastes Management in Ukraine until 2030 [2]. It is believed that the Strategy will contribute to increasing the efficiency of the use of state and local budgets to implement measures in the scope of handling with wastes for the purpose of prevention of negative impacts on the natural environment and human health. In this context, in our opinion, the main function of the ecological and economic assessment of the use and reproduction of natural resources should be the coverage of current costs, the level and amount of which can be judged on the degree of effectiveness – a qualitative characteristic of the various processes of using these resources.

The general lack of rates for estimation of force of process of handling with wastes in Ukraine with a glance of current costs necessitates for the development of appropriate approaches to such estimation. In the context of the National Strategy for Management by Wastes in Ukraine until 2030 (in particular, in the context of ensuring sustainable development of Ukraine through the implementation of tasks aimed at ecological and resource security, which requires of the implementation of specific management actions based on the results of calculations on certain rates) and an effective solution of waste management issues will focus on estimation of the force of the process of capital investment in protection of natural environmental (from micro to macro level), including management on directions (in particular, on the direction of handling with wastes). In accordance with the National Strategy for Management by Wastes in Ukraine until 2030, qualitative changes in the field of waste management in accordance with best environmental practices, in our opinion, will contribute to the consideration of the theoretical and applied aspects of metrology in the direction of both qualitative and quantitative measurement of the efficiency of the process of capital investment in protection of the natural environment (including directions). Improvement of the process of handling with wastes requires of management with use of modeling, including modeling based on the characteristics of the category and the appropriate rates of force for implementation of the author's SEE-analysis (which we consider the analysis of the force of processes based on models and rates of scale product, effectiveness and efficiency of the subprocesses of certain processes of functioning of complex systems). The realization of the results of the author's SEE-analysis of the force of this process at the state level helps to find the optimal options of actions for managing this process in the strategic perspective.

**Analysis of recent achievements and publications.** The categorical apparatus and the interpretation of rates of the efficiency of various processes, including the process of handling with wastes, are characterized by a certain specificity: by the variety of approaches

to this categorical apparatus and to the interpretation of the relevant rates, by the complexity of developing a unified methodological approach to the study of efficiency as characteristics of force (notably, of the ability of systems to give a certain result) of the process of functioning of complex dynamic systems. The scientific achievements of some authors are inherent in the identification of efficiency and effectiveness ([3, 4], etc.); certain authors distinguish these concepts ([5, 6] and others); there are also newest conceptual concepts ([7, 8, 9], and others). The consistent development of author's approaches to solving the problem of evaluating the force of the process through the components of efficiency with a glance of management needs (from the labor process (1996) to any process (2012)) was considered by us in paper [7] (2014) of collective monograph. Twenty years of research by Burennikova (Polischuk) N.V. and Yarmolenko V.O. the development of definitions and efficiency rates have shown that the force of the process of the functioning of complex systems based on the study of the category of efficiency of any process on the ultimate consequences simultaneously with the quantitative side, in the form of characteristic for scale product of process, and with qualitative side, taking into account the effectiveness of process, and their corresponding rates as indicators ([7, 8, 9], and others) require further explorations.

Significant scales of use of resources, energy and raw material specialization of the national economy with an outdated material and technical base, which determine the high indicators of the formation and accumulation of wastes, the consequences of production, including destructive nature, which are caused by the influence of technogenesis and other factors of unpredictable nature, need to focus on such a vision of efficiency, which contributes to greater understanding of the force for process of handling with wastes.

**The unsolved part** of the problem in the context of environmental protection and biodiversity, of other rules for land use remains to improve approaches to the methodology for estimation of efficiency of current costs on handling with wastes in Ukraine.

**Setting objectives.** The aim of the work is highlight of innovative authoring approaches to the SEE-analysis of the force for the process of capital investment on handling with wastes in Ukraine based on the estimation of the components of efficiency with the use of appropriate measurement and modeling.

**Presentation of the main research material.** All transformational transformations in agriculture should take into account the peculiarities of agricultural land as the main means of agricultural production and the multifunctional nature of rural economy, that is, to take its functions: economic (production of products for profit), social (ensuring food security and food independence of the country, promotion of employment of the rural population, etc.), environmental (preservation of the favorable environment for human life, soil protection from pollution and degradation, etc.). On the basis of these principles, the consequences of the relevant processes should be studied. The consequences of this are products of the process: as a benefit (pure product) – the net result of the process; as losses (costs, lost process possibilities); as a general (aggregate) product in the form of a product as a benefit and as a loss; a scale product in the form of a product as a benefit and as a part of the loss, proportional to the part of the product as a benefit in the general product (work ([7, 8, 9], etc.).

With a glance of the need to improve the ecological and economic situation in the country the process of guarantee an integrated approach to studying this situation is

important and is a complex process that requires new skills and abilities in management by this process. In system of management by the wastes in Ukraine, unfortunately, the tendency of inefficient implementation of economic instruments in the field of handling with these wastes and of the lack of use of appropriate measures of modern indicators for monitoring and control of management results has developed. One of the ways of this implementation can be the use of mathematics by constructing economic and mathematical models [10]. As we have repeatedly emphasized in our scientific publications, our author's models of change for efficiency of the process have the form:

$$J_R = J_K \cdot J_E = J_K \cdot J_{V/Z} = J_G \cdot J_{1+V/Z}; \quad (1)$$

$$J_R = J_G \cdot J_{1+Z/V} \cdot J_{G/Z} \cdot J_{V/G} = J_G \cdot J_{1+Z/V} \cdot J_{G/Z} \cdot J_{1+Z/G}, \quad (2)$$

where the indices  $J_R$ ,  $J_K$ ,  $J_E$  and others are indexes of the change of certain rates as the ratios of the corresponding rates to the basic rates. In these models,  $V$  is the rate of the total product of the process;  $Z$  – rate of its product as a cost;  $G = (V - Z)$  – rate of product as benefit of process;  $K = G + Z \cdot G/V$  – rate of scale product;  $E = V/Z$  – rate of the effectiveness of the process as a ratio of rate of the total product  $V$  and of rate the product as the cost  $Z$ ;  $R = K \cdot E = K \cdot V/Z = G(1 + V/Z)$  is rate of the efficiency of the process (in more detail form – in the works ([7, 8, 9], etc.).

We will make calculations on the indicated models. In table 1 shows capital investment and current expenses for process of handling with wastes in Ukraine (in actual prices, millions of UAH), and also the number of permanent population (by the end of the year), millions of persons in 2012-2016.

Table 1

**Capital investment and current expenses for process of handling with wastes in Ukraine and the number of permanent population of Ukraine in 2012-2016 \***

Rate	2012	2013	2014	2015	2016	Average
1) capital investments, millions of UAH *	730,5	713,9	784,0	737,5	2208,7	1034,92
2) current expenses, millions of UAH **	4756,2	4844,3	5417,0	6801,9	6719,6	5707,8
3) capital investments and current expenses, millions of UAH **	5486,7	5558,2	6201,0	7539,4	8928,3	6742,72
4) the number of permanent population, millions of persons *	45,4	45,2	42,8	42,6	42,4	43,68

\* Source: calculated by the author on the statistical yearbook [11, p. 199, 200, 26]

Some other rates are given in table 2 (expensive rates – on average per one year in UAH per one person, indices – in coefficients to the previous year).

According to table 1, we calculated the capital investment and current expenses  $V$ , current expenses  $Z$  for process of handling with wastes in Ukraine in 2012-2016, in dynamics.

On the basis of received the data it was made and given in the table 3 matrix (map) SEE-management based on the results of the SEE-analysis for the process of the

implementation of current expenses on handling with wastes in Ukraine in 2012-2016 (% to the average for 2012-2016) [9].

Table 2

**Dynamics of components of efficiency for the process of implementation of current expenses on handling with wastes in Ukraine in 2012-2016 \***

Year	Description of general product of process		Description of product as losses of process		Description of pure product of process	
	$V$	$J_V$	$Z$	$J_Z$	$G$	$J_G$
Average	6,515209	1	5,515208	1	1	1
2012	7,510883	1,152823	6,510883	1,180533	1	0,9999995
2013	7,785684	1,195001	6,785684	1,230359	1	0,9999995
2014	7,909439	1,213996	6,909439	1,252797	1	0,9999995
2015	10,22291	1,569085	9,222915	1,67227	1	0,9999995
2016	4,042333	0,6204456	3,042333	0,5516261	1	0,9999995
Year	Description of qualitative component of scale product		Description of scale product of process		Description of effectiveness of process	
	$1 + D_Z$	$J_{1+Z/V}$	$K$	$J_K$	$E$	$J_E$
Average	1,8465129	1	1,846514	1	1,181317	1
2012	1,8668599	1,011019	1,86686	1,011019	1,153589	0,976528
2013	1,8715591	1,013564	1,87156	1,013564	1,147369	0,9712628
2014	1,8735687	1,014652	1,873569	1,014652	1,14473	0,9690284
2015	1,9021805	1,030147	1,902181	1,030147	1,108426	0,9382966
2016	1,7526181	0,9491502	1,752618	0,9491497	1,328695	1,124758
Year	Description of quantitative component of effectiveness		Description of qualitative component of effectiveness		Description of efficiency of process	
	$J_{G/Z}$		$J_{V/G}$		$R$	$J_R$
Average	0,1813169		1		2,181318	1
2012	0,153589		1,152824		2,153589	0,9872881
2013	0,8127712		1,195001		2,14737	0,984437
2014	0,7982134		1,213997		2,14473	0,9832265
2015	0,5979894		1,569086		2,108426	0,9665834
2016	1,812821		0,6204459		2,328695	1,067564

\* Expensive rates are given on average per one year per one person in UAH in actual prices;  $V$  – capital investment and current expenses;  $Z$  – current expenses;  $G$  – capital investment. Indices – in the coefficients to the previous year ( $J_K = J_G J_{1+Z/V}$ ,  $J_E = J_{G/Z} J_{V/G}$ ,  $J_R = J_K J_E$ ). Source: calculated by the author

Our methodology (data in table 3) allows us to judge on how many percentages the relevant indexes of the components of the efficiency of the investigated process have changed in comparison with the average values, that is, it allows us to draw conclusions advice of following facts: as and for account of how components the rates of the products of the process change (including components of efficiency of the process). This table also shows the impact of  $F$ -impulses on the observable process,  $SEE$ -reserves (+) and  $SEE$ -risk (-) and advisable management  $SEE$ -effects.

An analysis of the results of calculations shows, for example, that in Ukraine in 2016 as compared with the average (data of row 34 of table 3), an increase for the level of efficiency of the process of implementation of capital investment on handling with wastes was observed in 6.756 pct (rate  $\Delta J_R$ ) for account of increase of the level of effectiveness on 5,085 pct (rate  $\Delta J_E$ ) with an increase of the level of scale product on 12,476 pct (rate  $\Delta J_K$ ). An increase of the level of scale product occurred with an almost constant level of capital investment (rate  $\Delta J_G$ ) and a reduction of the impact of a qualitative component of scale product on 5,085 pct (rate  $\Delta J_{1+Z/V}$ ). The increase of the level of effectiveness of the process is explained by an increase of the level of its quantitative component (rate  $\Delta J_{G/Z}$ ) on 81.282 pct with a decrease of the qualitative component (rate  $\Delta J_{V/G}$ ) on 37.955 pct.

Table 3

**Matrix (map) SEE-management on the results of SEE-analysis for the process of implementation of current expenses on handling with wastes in Ukraine in 2012-2016\***

Parameters of $F$ - impulses ( $F = R, K, E, G, 1+Z/V, G/Z, V/G, V, Z$ ) as tempos for increase of rates:									No of row
of efficiency $\Delta J_R$	of scale product $\Delta J_K$	of effecti-veness $\Delta J_E$	of pure product $\Delta J_G$	of qualitative component of scale product $\Delta J_{1+Z/V}$	of quantitative component of effectiveness $\Delta J_{G/Z}$	of qualitative component of effectiveness $\Delta J_{V/G}$	of general product $\Delta J_V$	of product as losses $\Delta J_Z$	
1	2	3	4	5	6	7	8	9	10
<b>2012</b>									1
-1,271	1,102	-2,347	0	1,102	-84,64	15,28	15,282	18,053	2
Impact of $F$ - impulses on observable process									3
negative	positive	negative	negative .	positive	negative .	positive	positive.	positive	4
Rates of SEE- reserves (+) and SEE- risks (-)									5
-	+	-	-	+	-	+	+	+	6
Advisable management $SEE$ - effects									7
Support of rise	Support of no less level	Support of rise	Support of rise	Support of no less level	Support of rise	Support of no less level	Support of no less level	Support of no less level	8
<b>2013</b>									9
-1,556	1,356	-2,874	0	1,356	-18,753	19,500	19,500	23,036	10
Impact of $F$ - impulses on observable process									3
negative .	positive	negative .	negative.	positive	negative.	positive	positive	positive	12
Rates of SEE- reserves (+) and SEE- risks (-)									13
-	+	-	-	+	-	+	+	+	14
Advisable management $SEE$ - effects									15
Support of rise	Support of no less level	Support of rise	Support of rise	Support of no less level	Support of rise	Support of no less level	Support of no less level	Support of no less level	16
<b>2014</b>									17
-1,678	1,465	-3,097	0	1,465	-20,179	21,400	21,400	25,28	18
Impact of $F$ - impulses on observable process									19
negative	positive	negative	positive	positive.	negative	positive	positive	positive	20
Rates of SEE- reserves (+) and SEE- risks (-)									21
-	+	-	+	+	-	+	+	+	22
Advisable management $SEE$ - effects									23
Support of rise	Support of no less level	Support of rise	Support of no less level	Support of no less level	Support of rise	Support of no less level	Support of no less level	Support of no less level	24

2015									25
-3,342	3,015	-6,170	0	3,015	-40,201	56,909	56,909	67,227	26
Impact of <i>F</i> - impulses on observable process									27
negative	positive	negative	positive.	positive.	negative	positive	positive	positive.	28

*Continuance of the Table 3*

1	2	3	4	5	6	7	8	9	10
Rates of SEE- reserves (+) and SEE- risks (-)									29
-	+	-	+	+	-	+	+	+	30
Advisable management <i>SEE</i> - effects									31
Support of rise	Support of no less level	Support of rise	Support of no less level	Support of no less level	Support of rise	Support of no less level	Support of no less level	Support of no less level	32
2016									33
6,756	5,085	12,476	0	-5,085	81,282	-37,955	-37,955	-44,837	34
Impact of <i>F</i> - impulses on observable process									35
positive	positive	positive	positive.	negative	positive	negative	negative	negative	36
Rates of SEE- reserves (+) and SEE- risks (-)									37
+	+	+	+	-	+	-	-	-	38
Advisable management <i>SEE</i> - effects									39
Support of no less level	Support of no less level	Support of no less level	Support of no less level	Support of rise	Support of no less level	Support of rise	Support of rise	Support of rise	40

*\*The rates of growth of the indexes of the components of the efficiency of the process of capital investment for the implementation of current expenses in Ukraine in 2012-2016 are presented as a percentage. Source: calculated by the author.*

Values of rates  $\Delta J_Z$ ,  $\Delta J_G$ ,  $\Delta J_V$ ,  $\Delta J_{1+Z/V}$ ,  $\Delta J_K$ ,  $\Delta J_E$ ,  $\Delta J_R$ ,  $\Delta J_{G/Z}$ ,  $\Delta J_{V/G}$  from table 3 characterize the degree of influence of the relevant factors on the formation of products of the process of implementing current expenses on handling with wastes in Ukraine. They, by our method, can be both negative and positive; their absolute value characterizes the volume of influence of certain factors on the formation of products of the process, and the sign – the direction of influence. These factors for the process the implementation of current expenses on handling with wastes in Ukraine are: current expenses on handling with wastes (with rate *Z*); capital investment (with rate *G*); capital investments and current expenses (with rate *V*); qualitative component of a scale product (with rate  $1 + Z/V$ ); scale product of the process (with rate *K*); effectiveness of process (with rate *E*); efficiency of process (with rate *R*); quantitative component of effectiveness of process (with rate *G/Z*); qualitative component of effectiveness of process (with rate *V/G*).

Under the *F*-impulses of the process, as we have done before, we will understand the factors that contribute to the formation of products of this process ( $F=Z, G, V, 1 + Z/V, K, E, R, G/Z, V/G$ ), and under the products of the process – the costs of its functioning, clean and general products; scale, effectiveness and efficiency of the process etc. [8].

The author's *SEE* analysis of the current expenses on handling with wastes in Ukraine, which we implemented in the proposed article, provides an analysis of the force of this process with our author's indicators of the scale product, effectiveness, and efficiency of the subprocesses of the process, obtained on the basis of the products of these subprocesses – as benefits (clean products, net results, useful features of subprocesses); as losses (expenses, lost opportunities of subprocesses); as general (aggregate) products in the form of products as benefits and as losses (aggregate possibilities of subprocesses); as scale products in the form of products as benefits and as those parts of the losses that are proportional to the share of the products as benefits to common products. Such an analysis will facilitate the development of a provision on an electronic information logistics scheme

for the use of natural resources and of handling with wastes in accordance with the National Strategy for Wastes Management in Ukraine until 2030. Results of the measurement of the degree of influence of the relevant factors on the formation of products of the investigated processes, which are reflected in table 3 (in standard units of measurement), characterized by the magnitude (positive or negative) of the corresponding impulses, the absolute value of which indicates on their power, and the sign – on the direction of action, will allow the introduction of a waste management system on an innovative basis [9]. Such a system will help monitoring of the consumption of natural resources under the scheme “natural resources – useful products – waste – secondary resources – useful products – waste”, as required by the National Strategy. Valuable in the context of handling with wastes is also consideration of experience of the countries of the European Union, considered, for example, by the author Navrotsky L.R. in [12]. Let us clarify that relative to the process of implementation of capital investment on handling with wastes in Ukraine as compared with the average negative impulses were R-, E-, (G/Z)-impulses in 2012-2016 and positive impulses were all others; in 2016 the positive impulses were R-, K-, E-, G/Z-impulses and negative – all others, which would allow to implement the above-mentioned monitoring also as compared with other countries of the world.

In Ukraine levels of efficiency of observable process as compared with the average values have decreased in 2012-2016 for account of decrease of effectiveness of capital investments. In 2016 the level of efficiency as compared with the average values has increased for account of increase of a scale product and of effectiveness of the process of the implementation of current expenses on handling with wastes in Ukraine. This requires of consideration of the above-mentioned results in the formulation of proposals for prognostication of the consequences of the process, which will contribute by increase of the force of this process and require of appropriate management.

**Conclusions and perspectives of further research.** The processes of the generation, storage, accumulation, recycling, utilization and burial of wastes that carry ecological threats in consequence of large scales of these processes, need of adequate management with a glance of European approaches based on the updated legislative framework. The ineffectiveness of the implemented economic instruments in the field of handling with wastes has led to the need to prevent the corresponding negative consequences in this area. Estimation of the force of current expenses on handling with wastes in Ukraine, which can be carried out in accordance with our authoring rates of components of efficiency as indicators and in accord with the appropriate methodology for applying these rates for comparative analysis of the process on the basis of authoring *SEE*-analysis and *SEE*-management, will contribute to the creation of an integrated system for management of wastes as required by the National Strategy for Wastes Management in Ukraine until 2030. These approaches will contribute to the development of the national economy in the context of its effective functioning. Our future research is intended to direct on the settlement of questions of rational handling with the resource potential of the efficient functioning of the national economy with a glance of the closed cycle of production, using such innovative authoring techniques as *SEE*-analysis and *SEE*-management.

### References

1. Nagirnyak T.B. Grabovskyj R.S., Grycyna M.R. (2017). Ekologo-ekonomichni aspekty racionalnogo vykorystannya i oxorony zemelnyx resursiv v Ukrayini [Ecological-economic aspects of rational use and protection of land resources in Ukraine]. *Naukovyj visnyk LNUVMB imeni S.Z. Gzhyckogo*. T. 19, no. 79. 111-116 [in Ukrainian].



2. Rozporyadzhennya Kabinetu Ministriv Ukrayiny vid 8 lystopada 2017 r. (2017). No. 820-r "Pro sxvalennya Nacionalnoyi strategiyi upravlinnya vidxodamy v Ukrayini do 2030 roku" [Order of the Cabinet of Ministers of Ukraine dated November 8, 2017 No. 820-p "On Approval of the National Strategy for Waste Management in Ukraine until 2030"]. Access Mode: <http://zakon.rada.gov.ua/laws/show/820-2017-%D1%80> [in Ukrainian].
3. Bolshoi ekonomicheskii slovar [avtor-sostavitel A.B. Borisov] (2007). [Big economic dictionary [aut.-cons. A.B. Borisov]]. Moscow: Knizhny mir. 860 p. [in Russian].
4. Marr B. (2014). Klyucheve pokazateli yeffektivnosti. 75 pokazatelei, kotorye dolzhen znat kazhdyi menedzher [Yelektronnyi resurs]. [Key Performance Indicators. 75 indicators to be known by each manager [Electronic resource]]. Translation from English of A.V, Shavrin. Moscov: BINOM. Laboratorija znanii,. 340 p. [in Russian].
5. Parmenter D. (2010). Key performance indicators: developing, implementing, and using winning KPIs. Wiley. 299 p.
6. Druker P. (2015). Praktika menedzhmenta [Management practice]. Translation from English of I. Verigin. Moscov: Mann, Ivanov i Ferber. 416 p. [in Russian].
7. Polishchuk N.V., Yarmolenko V.O. (2014). Henezys avtors'kykh pidkhodiv do rozvyazannya problemy otsinyuvannya diyevosti funktsionuvannya skladnykh system za dopomohoyu skladovykh rezul'tatyvnosti [Genesis of author's approaches to solving the problem of estimation of the force of functioning of complex systems with the help of components of efficiency]. *Ekonomika XXI storichchya: problemy ta shlyakhy yikh vyrishennya: monohrafiya*. [Economics of the XXI Century: Problems and ways of their solution: monograph]. Za zah. red. H.O. Doroshenko, M.S. Pashkevych; Min-vo osvity i nauky Ukrayiny; Khark. in.-t finansiv; Nats. hirn. un-t. D.: NHU. 394 p. 359-369 [in Ukrainian].
8. Yarmolenko V.O., N.V. Burennikova (Polishchuk) (2015). Vykorystanniy F-impulsiv yak indykatoriv spriamovanosti naslidkiv protsesiv funktsionuvannia skladnykh system v avtorskomu SEE-analizi diievosti protsesiv na osnovi skladovykh rezultatyvnosti [Using F-impulses as indicators of the directivity of the consequences of the processes of the functioning of complex systems in the author's SEE-analysis of the force of processes on the basis of components of efficiency]. *Sbornik nauchnykh trudov SWorld*. No. 1(38). T. 18. *Ekonomika*. Ivanovo: Markova A.D. 4-13. TSYT 115-032 [in Ukrainian].
9. Buryennikova N.V., Yarmolenko, V. O. (2016). *SEE-upravlinnya na bazi skladovykh rezultatyvnosti yak zasib pidvyshchennya diyevosti protsesu funktsionuvannya skladnykh system: sutnist, metodolohiya* [SEE-management on the basis of components of efficiency as a means of increasing the force of the process of functioning of complex systems: the essence, methodology]. *Biznes Inform*. No 1. 145-152 [in Ukrainian].
10. Cherevko H.V., Yatskiv M.I. (2001). *Ekonomika pryrodokorystuvannya: navch. Posibnyk* [Economics of the use of natural resources: educational manual]. Lviv: Svit. 214 p. [in Ukrainian].
11. Statistichniy shorichnyk Ukrayiny za 2015 rik [Statistical Yearbook of Ukraine for 2016] (2016). Kyiv. 575 p. [in Ukrainian].
12. Navroczkyj R.L. (2016). Dosvid krayin Yevropejskogo soyuzu v sferi bezpechnogo povodzhennya z tverdymy pobutovymy vidxodamy [Experience of countries of the European Union in the field of safe treatment with of solid home wastes]. *Ekonomika ta suspil'stvo. Elektronne naukove faxove vydannya*. No. 7. 621-625. Rezhym dostupu: [www.economyandsociety.in.ua/journal/7\\_ukr/7\\_.pdf](http://www.economyandsociety.in.ua/journal/7_ukr/7_.pdf). [in Ukrainian].

**АНОТАЦІЯ**  
**SEE-АНАЛІЗ ДІЄВОСТІ ПРОЦЕСУ**  
**ПОВОДЖЕННЯ З ВІДХОДАМИ В УКРАЇНІ**

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*Реалізовано методика аналізу дієвості процесу поводження з відходами в Україні на базі авторських складових результативності. Зазначену методика засновано на SEE-аналізі складних систем, який висвітлено у раніше опублікованих роботах авторки у співтворчості з В.О. Ярмоленком. Складову частину цього аналізу становить знаходження F-імпульсів підпроцесів певних процесів, які мають місце у системах різних типів. Такими імпульсами є фактори, що слугують формуванню продуктів відповідних процесів. Числові значення цих імпульсів зведено у матрицю, котра містить показники темпів приросту складових результативності процесу поводження з відходами в Україні та котра характеризує ступінь впливу певних факторів на формування продуктів цього процесу. Застосовано висловлене у раніше опублікованих авторських роботах та на конкретних прикладах підтверджено положення про те, що SEE-аналіз є невід'ємною складовою SEE-управління, за результатами якого сформульовано пропозиції стосовно цього управління у контексті Національної стратегії управління відходами в Україні до 2030 року.*

**Ключові слова:** капітальні інвестиції та поточні витрати на поводження з відходами; Національна стратегія управління відходами в Україні до 2030 року; показники масштабного продукту, ефективності та результативності процесу; F-імпульси, SEE-аналіз та SEE-управління процесу, моделі складових результативності Буреннікової (Поліщук) – Ярмоленка.

**Табл.: 3. Літ.: 12.**

**АННОТАЦИЯ**  
**SEE-АНАЛИЗ ДЕЙСТВЕННОСТИ ПРОЦЕССА**  
**ОБРАЩЕНИЯ С ОТХОДАМИ В УКРАИНЕ**

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*Реализована методика анализа действенности процесса обращения с отходами в Украине на базе авторских составляющих результативности. Указанная методика основана на SEE-анализе сложных систем, которая представлена в ранее опубликованных работах автора в сотворчестве с В.А. Ярмоленко. Составной частью этого анализа является нахождение F-*

*импульсов подпроцессов определенных процессов, имеющих место в системах различных типов. Такими импульсами являются факторы, которые способствуют формированию продуктов соответствующих процессов. Числовые значения этих импульсов сгруппированы в матрицу, содержащую показатели темпов прироста составляющих результативности процесса обращения с отходами в Украине и характеризующую степень влияния определенных факторов на формирование продуктов этого процесса. Использовано высказанное в ранее опубликованных авторских работах и на конкретных примерах подтверждено положение о том, что SEE-анализ является неотъемлемой составляющей SEE-управления, по результатам которого сформулированы предложения по этому управлению в контексте Национальной стратегии управления отходами в Украине до 2030 года.*

**Ключевые слова:** капитальные инвестиции и текущие расходы на обращение с отходами; Национальная стратегия управления отходами в Украине до 2030 года; показатели масштабного продукта, эффективности и результативности процесса; F-импульсы, SEE-анализ и SEE-управление процесса, модели составляющих результативности Буренниковой (Полищук) – Ярмоленко.

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#### **Інформація про автора**

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