ECONOMIC PROCESSES MANAGEMENT
international scientific e-journal (ISSN 2311-6293)
epm.fem.sumdu.edu.ua
№3 – 2017

International aspects of economic processes management

Cite This Article:
Shkola V. Yu., Domashenko M. D., Kuchmiyov A. V., Shkola Yu. O. Governing ecological security of the global economic systems / [Online] // *Economic Processes Management: International Scientific E-Journal*. 2017. № 3. Available: http://epm.fem.sumdu.edu.ua/download/2017_3/epm2017_3_5.pdf

Received
June 25, 2017

Accepted
August 30, 2017

UDC 502.1:339.9
JEL Classification: F020, F290, L510, O120, P450

GOVERNING ECOLOGICAL SECURITY OF THE GLOBAL ECONOMIC SYSTEMS[1]

Shkola Viktoriia Yuriyivna
Candidate of Economic Sciences, Associate Professor,
Associate Professor of the Department of economic theory
Sumy State University (Sumy, Ukraine)
Domashenko Maryna Dmytrivna
Candidate of Economic Sciences,
Associate Professor of the Department of Economic Theory,
Sumy State University (Sumy, Ukraine)
Kuchmiyov Andrew Volodymyrovych
Candidate of Economic Sciences (Kyiv, Ukraine)
Shkola Yulia Oleksandrivna
Lecturer of the Department of English Philology,
National Pedagogical Dragomanov University (Kyiv, Ukraine)

Factors complex is formed, which describe constituents in the global economic system. Theoretical and methodic approach to choose marketing strategies to provide ecological security of the economic system, based on economic system ecological security estimation methodics, is improved. Methodic approach to ground complex of instruments concerning economic system ecological security provision, based on the factors to estimate their potential, level of the ecological security and factors of the economic system development synchrony and ecological security provision, is suggested. Methodic approach to estimate processes synchrony to provide ecological security in the economic system, is suggested.

Keywords*: ecological security, global economic system, synchrony, strategy, sustainable development.*

[1] The paper was written according to budget money from the Ministry of Education and Science in Ukraine, given to develop research topic № 53.15.01-01.15/17.GF "Methodology of forming mechanism of national economy innovative development based on alternative energy".

Problem statement. Irrational use of natural resources during many years, structural changes, occurred in the economical complex of the state, and also low level of the ecological society consciousness lead to great environment degradation. The main reason of the mentioned negative changes became absence of the environmental management effectively active legal, administrative and economic mechanisms in the environmental management, which didn't consider rational and effective use of the natural resources. Owing to it problems of environment saving, renewing and improving are of special attention [3], solving of which depends on sustainable development provision, based on the interconnection between economic systems and nature, when global economic system ecological security is achieved.

One of the main problems on the way to fasten achievement of the sustainable development in the global environment includes difficulties to use instruments to provide ecological security in economic systems at any level (global, regional, state) in practice. It is determined by absence of the universal methodic approach to choose strategies, and within them – tools to provide ecological security of the economic system and necessity to adapt the existing tools to specific development of each separate economic system at lower level.

Analysis of the recent research and publications. Theoretical and applied issues dealing with ecological safety management have been investigated by ukrainian and foreign academicians [1, 2, 8, 9, 11, 12]. At the same time, in spite of having been made profound and significant research contributions to the above mentioned problem, solved by such scientists, the problem of formation of the new paradigm to global economic systems ecological security governing, based on globalization approach to nature management and environmental protection in conditions of integration processes has not been solved yet.

The object of the article is to develop scientific and methodological issues dealing with governing ecological security of the global economic systems.

Results. The modern world economy may be determined as global economic system, including components of the motivational, providing and regulating subsystem, which interconnect as one unit. It conditions focus and level of the society social and economic development, and provides stable ecological and economic balance and stability of internal evolutional transformations during continuous changes. The motivational subsystem plays an important role in the economic system. It determines other subsystems directions and orientation of all reproducing processes on a global basis. Increasing role of the ecological constituent in the structure of various components in economic system (motivational subsystem) is explained by necessity to satisfy existing and potential needs, which is formed considering economic system and impact level of eco-destructive factors, without threat to exhaust the integral resource potential and opportunity to provide future generations' interests and needs in long perspective. These human's needs as biological and social

creature, which are formed in close interconnection with natural environment factors, dictate necessity of innovative activity ecologization in all economy spheres [10].

Structurally global economic system will be observed as totality of economic, ecological and social subsystem, explored in paper [6].

Marketing strategies to provide ecological security are suggested to be observed, proceed from ecodestructive decrease and ecoconstructive increase impact on the environment through ecologization production sphere, trade and consumption, based on innovations use, and tools of positive and negative motivation.

To choose marketing strategies to provide ecological security of the global economic system is suggested on the bases of its ecological security level estimation, considering real conception of the innovative activity ecologization. Innovative activity ecologization concepts, distinguished depending on development stages of the ecological motivation development stages, is shown in the work [7]

LES is suggested to observe as complex factor, which is calculated by formula

$$LES = f(Leg, Lep, Lesi, R), \tag{1}$$

$$Leg, Lep, Lesi, \mathrm{Re} = \begin{cases} 1, \ if \ \ Leg \geq 0{,}5, \ \ Lep, Lesi, R < 0{,}75, \\ 0, \ if \ \ Leg < 0{,}5, \ \ Lep, Lesi, R \geq 0{,}75, \end{cases} \tag{2}$$

where *Leg* – level of the goods ecological compatibility; *Lep* – level of the production ecological compatibility; *Lesi* – level of the ecological security of the providing infrastructure; *R* – risk of the emergencies.

In general the following levels of ecological security are distinguished [7]:

I Natural is not changed directly by human's economic activity (local nature feels only weak mediate impacts from global manmade changes).

II Balanced – speed of the reviving processes is higher or equal rates of the manmade breaks.

III Critical – speed of the manmade breaks exceeds rates of nature self-reviving, but great change doesn't take place in the natural system.

IV Crucial – reviving substitution of the previous ecological systems by manmade pressure for less ones.

V Catastrophic – hardly reviving substitution of the ecological systems under manmade pressure for less productive, strengthening of the less productive systems.

VI Collapse – not reviving loss of the biological productivity.

I-II levels of the ecological security provide ideal conditions for human functioning, reviving and development, III-IV levels put at hazard for generations functioning, reviving and development, V level – for today's and future generations, VI – leads to human and other biological types death.

Choice of the marketing strategy to provide ecological security is suggested to

conduct due to the received values of the ecological security level, considering innovative activity ecologization real conception (table 1).

Choice of the tools to provide ecological security in the economic system is suggested to conduct on the basis of their potential estimation.

Table 1. **Choice of the marketing strategies to provide ecological security in the economic system**

LES		**Real conception of the ecologization**			
		I	**II**	**III**	**IV**
Level I	(1;1;1;1)	A, B, D	A, B, D	B, F, G	C, G, H, J
Level II	(1;1;1;0)	A, D	A, B, D	B, C, D, F, G	B, F, G, H, J
	(1;1;0;1)	A, B, D, E	A, D, E	B, C, F, G	F, G, H, J
	(1;0;1;1)	A, B, D	A, B, D, E	C, F, G	F, H, J
	(0;1;1;1)	A, B, D, E	B, D, E	B, E, F, G	G, H, J
Level III	(1;0;1;0)	A, B, D, E	A, B, D, E	B, C, F, G	F, G, H, J
	(1;0;0;1)	A, B, D,	A, B, D, E	B, E, F, G	B, F, G, H, J
	(1;1;0;0)	A, B, D,	B, D, E	B, C, F, G	F, G, H, J
	(0;0;1;1)	A, B, D, E	A, B, D, E	B, E, F, G	G, H, J
	(0;1;1;0)	A, B, D, E	A, B, D, E	C, F, G	F, G, H, J
	(0;1;0;1)	B, D, E	A, B, C, D, E	B, E, F, G	F, G, H, J
Level IV	(1;0;0;0)	A, B, D, E	A, B, D, E	C, F, G, H	G, H, J
	(0;1;0;0)	B, D, E	A, B, C, D, E	B, E, F, G	F, G, H, J
	(0;0;1;0)	A, B, D, E	A, B, D, E	C, E, B, F	F, G, J
	(0;0;0;1)	B, D, E	A, C, D, E	B, E, F, G	B, F, G, H, J
Level V	(0;0;0;0)	A, B	A, B, D, E	B, D, E, F	B, F, G, H, J

A – Strategy of changes; B – Strategy of adaptation; C – Strategy of support; D – Strategy of the "clean" production; E – Strategy of initiative; F – Strategy of the producers' motivation; G – Strategy of the consumers' motivation; H – Strategy of diversification; J – Strategy of integration

Source: personal study

Authors determine that *marketing instruments potential* is an ability to impact the market structure, formed by principle of ecological factors dominating, through formationa and fastening of the ecologically oriented needs in various markets segments. Estimation of the instruments potential is suggested to carry out by factors which allow qualitatively and quantitively to estimate the processto form conscious ecological need among consumers, – index of consumers' reaction and market structure dynamics.

Index of consumers' reaction is suggested to be factor which show consumers' values and needs change as a result of society awareness and ecological consciousness formation. Observing it through the prism of consumers behavior

ecologization and ecological security provision, one sets that it is indicator of the dominating ecologization conception and sustainable development. Index of the consumers' reaction has to be determined in the following sequence:

1) segmentation of consumers, based on their questionnaire, quantitive and structural factors of every segment ("green", "caring", "economic", "ripened", "grey", "indifferent"). To segment consumers, one suggests methodic, described in the work [5];

2) prognostication of the ecological needs formation dynamics under information impact, which is necessary for their consumers' behavior change.

One suggests to observe two groups of consumers in order to estimate ecological needs formation: group 1 is with real or formed ecological need, and group 2 is with potential or not formed ecological need. Group 1 is represented by consumers' segments "green", "caring", "economic", "ripened", for which ecological compatibility is consumers' value, i.e. they realize consumer's need to provide ecological security (personal or the whole family). Group 2 includes representatives of segments "grey" and indifferent", in which need in ecological security provision has not been formed yet. We have to mention that such consumers' groups exist in the natural objects' mutual synchronization (self-synchronization) problem area. Speed of consumers' number growth in each group is proportional to the consumers' number in each of them. Analytically it can be presented by the following equation system, which is also suggested to use for ptognostication of the ecological needs formation dynamics under information impact:

$$\begin{cases} G_1(t) = \dfrac{\xi[G_1(t_0)+G_2(t_0)]}{1+\left(-\omega^{(z)}t\right)^e \cdot \left(\dfrac{\xi[G_1(t_0)+G_2(t_0)]}{G_1(t_0)}-1\right)}, \\ \dot{G}_1(t)+\dot{G}_2(t)-\xi[G_1(t)+G_2(t)]=0, \quad G_2(t)\to 0, \end{cases} \tag{3}$$

where $G_1(t)$, $G_2(t)$, $G_1(t_0)$, $G_2(t_0)$ – number of consumers of group 1 and group 2 in time t and t_0; $\omega^{(z)}$ – independent speed of the process to provide ecological security ($\omega^{(z)}>0$) (more details see p. 3); ξ – coefficient of the rationality in consumers' number change in group (it shows rationality of consumers' transfer from one group into another); $\dot{G}_1(t)$, $\dot{G}_2(t)$ – speed of the consumers' number change in groups 1 and 2 due to the time t;

3) determination of the consumers' reaction index to marketing tools.

Index of the consumers' reaction to the proper tools is suggested to define on the basis of real and potential ecological necessity estimation by formula

$$I(t)=1-\frac{G_2(t)}{G_1(t)}, \tag{4}$$

where $G_1(t)$ – number of group 1 consumers in the time *t*, defined as integral capacity of "green", "caring", "economic", "ripened" segments; $G_2(t)$ – number of the group 2 consumers in the time *t*, defined as integral capacity of segments "grey" and "indifferent".

The scale of factor values $I(t)$ is shown in the table 2.

Table 2. **Value of the consumers' reaction index**

Reaction level	Critical	Very high	High	Middle	Low	Crucial
Value $I(t)$	$I(t)=1$	$0,8 \le I(t) < 1$	$0,6 \le I(t) < 0,8$	$0,4 \le I(t) < 0,6$	$0,2 \le I(t) < 0,4$	$0 \le I(t) < 0,2$

Source: personal study

Market structure dynamics has to be determined by such factors which are calculated at the time *t*: part of the consumers from group 2 $g_2(t)$, change of the consumers' part in the group 2 $\Delta g_2(t)$, part of the consumers from group 1 without segment "ripened" considering $g_1^*(t)$ and change of the consumers part from group 1 without considering "ripened" segment $\Delta g_1^*(t)$.

The scale to determine level of the tools potential for economic system ecological security is presented in the table 3.

Table 3. **Levels of the marketing tools potential**

Factors value				
$I(t)$	Value g_1^*, g_2, Δg_1^*, Δg_2			
$I(t)=1$	$g_1^*(t) \cong 1$, $\Delta g_2(t)=0$	$\Delta g_1^*(t) > 0,05 \Leftrightarrow g_1^*(t) > 0,9$ $\Delta g_2(t) \cong -0,2$	$0,03 \le \Delta g_1^*(t) \le 0,05 \Leftrightarrow g_1^*(t) \ge 0,9$, $-0,2 \le \Delta g_2(t) < -0,1$	$0 \le \Delta g_1^*(t) < 0,03$, $-0,1 \le \Delta g_2(t) \le 0$
$0,8 \le I(t) < 1$	x	$\Delta g_1^*(t) > 0,2 \Leftrightarrow g_1^*(t) \ge 0,75$, $\Delta g_2(t) \cong -0,2$	$0,1 \le \Delta g_1^*(t) \le 0,2 \Leftrightarrow g_1^*(t) \ge 0,75$, $-0,2 \le \Delta g_2(t) < -0,1$	$0 \le \Delta g_1^*(t) < 0,1$, $-0,1 \le \Delta g_2(t) \le 0$
$0,6 \le I(t) < 0,8$	x	$\Delta g_1^*(t) > 0,25 \Leftrightarrow g_1^*(t) \ge 0,55$, $\Delta g_2(t) \cong -0,2$	$0,13 \le \Delta g_1^*(t) \le 0,25 \Leftrightarrow g_1^*(t) \ge 0,55$, $-0,2 \le \Delta g_2(t) < -0,1$	$0 \le \Delta g_1^*(t) < 0,13$, $-0,1 \le \Delta g_2(t) \le 0$
$0,4 \le I(t) < 0,6$	x	$\Delta g_1^*(t) \ge 0,2 \Leftrightarrow g_1^*(t) \ge 0,35$, $\Delta g_2(t) \cong -0,2$	$0,1 \le \Delta g_1^*(t) < 0,2 \Leftrightarrow g_1^*(t) \ge 0,35$, $-0,2 \le \Delta g_2(t) < -0,1$	$0 \le \Delta g_1^*(t) < 0,1$, $-0,1 \le \Delta g_2(t) \le 0$
$0,2 \le I(t) < 0,4$	x	$\Delta g_1^*(t) \ge 0,15$, $\Delta g_2(t) \cong -0,2$	$0,08 \le \Delta g_1^*(t) < 0,15$, $-0,2 \le \Delta g_2(t) < -0,1$	$0 \le \Delta g_1^*(t) < 0,08$, $-0,1 \le \Delta g_2(t) \le 0$
$0 \le I(t) < 0,2$	x	$\Delta g_1^*(t) > 0,05$, $\Delta g_2(t) \cong -0,2$	$0,03 \le \Delta g_1^*(t) \le 0,05$, $-0,2 \le \Delta g_2(t) < -0,1$	$0,03 \le \Delta g_1^*(t) \le 0,05$, $-0,1 \le \Delta g_2(t) \le 0$
Level of the instruments potential	**Critical**	**High**	**Sufficient**	**Low**

Source: personal study

Within every strategy chooses marketing instruments, introduction of which may be complex or prior, owing to the resource supply of the economic system and its development expected factors.

Formation of the marketing tools complex is suggested on the basis of global economic system development scenario formation, which is analytically written as multisets of the total scenario group concerning final choice formation (formula (5)).

$$V = \{V_j\} = \left(f, X^{(s)}, Z, F_j\right) \rightarrow opt,\ f : \{X^{(s)}, Z\} \rightarrow \{F\}, \quad (5)$$

where V – set of the economic system development scenario; V_j – act to choose j-scenario; $X^{(s)}$ – set of s- subsystem functions; Z – set of the marketing tools, $Z = \{z_1, z_2, \ldots z_k\}$; F – set of functions f values, which correspond full group of scenarios, $F = \{F_j\}$, $F_j = \{\omega_j, I_j, LES_j, g_1, g_2, \Delta g_1^*, \Delta g_2^*\}$; ω_j – speed of the system synchronous developmenty; I_j – index of the consumers' reaction to the marketing tools, which correspond j-scenario; LES_j – expected LES of the economic system while realization of j-scenario; g_2, Δg_2 – part and change of the consumers' part in group 2 accordingly; g_1^*, Δg_1^* – part and change of the consumers' part in group 1 without considering the segment "ripened".

One has to mention that methodic approach allows not only to determine real state of the ecological security, but also to face various crisis phenomena owing to complex approach to choose estimation factors.

The efficiency of the instruments which provide ecological security depends on economic system balanced development and proper processes rate, conditioned by introduction of the z-instrument. Estimation of the processes synchrony which provide ecological security in the economic system is suggested to carry out on the basis of factors correlation, which characterize system development and every process, – speed of the system synchronous development ω and aautonomous speed of the process to provide ecological security $\omega^{(z)}$, formulas for calculation of which are suggested by authors.

Speed of the synchronous development in the economic system ω (ω>0) is suggested to determine from set of equations, describing its development [6]:

$$\begin{cases} \dot{x}^{(s)} = X^{(s)}\left(x^{(s)}(t)\right), \\ \dot{y} = \varepsilon^{(z)^{\gamma}} Y\left(x^{(1)}, x^{(2)}, x^{(3)}, y(t)\right), \\ x^{(s)}(t) = \alpha^{(s)}\left[\theta^{(s)^{\beta}}\omega t + f^{(s)}\left(x_1^{(s)},\ldots,x_i^{(s)},\ldots,x_{n_s}^{(s)},\delta^{(s)},\omega,t\right)\right] \\ y(t) = \Lambda\left(y^{(1)}(t),\ldots,y^{(z)}(t),\ldots,y^{(k)}(t)\right), \\ y^{(z)}(t) = \alpha^{(z)}\left[\mu^{(z)^{\lambda}}\omega t + {}^{(z)^{m}}\cdot u^{(z)}\left(g^{(z)}y_1^{(z)}, y_2^{(z)}, \tau^{(z)},\omega,t\right)\right], \\ s \in [1;3],\ \ i \in [1;n_s],\ \ z \in [1;k],\ \ t \in [1;T], \end{cases} \tag{6}$$

where $x^{(s)}(t)$ – function of s-subsystem state, represented by n_s-vector, in the moment time t; $x^{(1)}$, $x^{(2)}$, $x^{(3)}$ – functions of the economic, ecological and social subsystem state; $y(t)$ – function, describing system of connections in the time moment t; $x_i^{(s)}$ – i-factor, describing subsystem $x^{(s)}$; $\dot{x}^{(s)}$, $\dot{y}$ – derived functions $X^{(s)}$, Y accordingly; Y – k-vector-function; $y^{(z)}(t)$ – k-vector, describing character of interconnections in the system, which appear as a result of z-process (tool) introduction; $\alpha^{(s)}$ – stability index of the s-subsystem; $\alpha^{(z)}$ – stability index of connections in the system considering z-process impact; $\theta^{(s)^{\beta}}$ – coefficient of aggregation of s-subsystem with environment (with reinforcing character of actions β=1, with decreasing – -1); $\mu^{(z)^{\tau}}$ – aggregation coefficients of the z-process with environment (with reinforcing character of actions τ=1, with decreasing – -1); $\varphi^{(z)^{m}}$ – space coefficient of the efficiency in z-process (with strengthening character of action m =1, with decreasing – -1); $\varepsilon^{(z)^{\gamma}}$ – coefficient, which considers social, economic and ecological effects synergism after introduction of the z-marketing instrument and synergism as a result of effects addition in every t-period to previous ones (with strengthening character of action γ=1, with decreasing – -1); $f^{(s)}$, $u^{(z)}$, Λ – mathematic functions; $\delta^{(s)}$ – coefficient of the mutual correlation of the constituents in s-subsystem; $g^{(z)}$ – the potential speed coefficient of expenses return for introduction of z-process; $\tau^{(z)}$ – coefficients of the mutual correlation connections in z-rocess with others; $y_1^{(z)}$, $y_2^{(z)}$ – components of vector $y^{(z)}$; T – duration of the investigated period; k – number of processes to provide ecological security within investigated system in period t; t – time features of the system development; s, z – ordinal number according to the subsystem and process to provide ecological security, conditioned by the proper instrument introduction; i – ordinal number of the factor, which describes subsystem $x^{(s)}$; n_s – number of factors, which describe subsystem $x^{(s)}$.

Considering the fact that costs, designed to ensure a certain result and the expected effect are not always coincided in time. Moreover, they can be stretched in time. While forecasting and estimation of the expected financial flows one has to consider rate of return in the investigated process through time factor. Existence of the time state between the start of the process in ecological security and result

receiving preconditions to introduce corrective coefficientg $g^{(z)}$. Its value is established on the basis of the process category definition ("fast", results of which are observed in the short term perspective, or "slow", the results of which are observed only in the medium and long term perspective, "dot", resulting in a static variable, or "prolonged "results are observed in the dynamics as relatively constant, evenly distributed over time) as well as current and potential concept of economic system ecologization. Value of the coefficient $g^{(z)}$ is determined according to the values table, developed by authors and based on the retrospective factors analysis, which correspond various processes and acts concerning ecological security provision of the global economic system (in more details see [4]).

In order to simplify the suggested factor use, factor values $\alpha^{(s)}$, $\theta^{(s)}$, $\delta^{(s)}$, $\mu^{(z)}$, $\tau^{(z)}$ are determined owing to correlative and regressive analysis of the output data. Values $\varphi^{(s)}$, $\varepsilon^{(z)}$, m, β, λ, γ are established on the basis of existing experience or by expert's method – if there are no retrospective data.

Thus, system synchrony speed (frequency) index ω, determined from formula (1) should be compared with autonomous frequency (speed) index of the process development (actions or many actions) to provide ecological security $\omega^{(z)}$, calculated by formula [6]:

$$\omega^{(z)} = \frac{4T^{1/2} \cdot \dot{y}^{(z)}(t)}{1 + y^{(z)}(t)}. \qquad (7)$$

The biggest ecological and economic efficiency is achieved by the system if $\omega^{(z)} = \omega$, i.e. there is ***full synchrony*** of the processes to provide ecological security and economic system development. If $\omega^{(z)} < \omega$, we can affirm that there is ***interval synchrony*** of processes to provide ecological security. If $\omega^{(z)} > \omega$, we can confirm that there is ***impulse synchrony*** among processes to provide ecological security.

We have to mention that suggested theoretical and methodic approach to estimate processes synchrony to provide economic system ecological security, which considers changes of the ecological security level in economic system, expenses level to introduce marketing instruments, synergy of interconnection between these tools, subsystems and systems at various levels, provides flexibility to form the most optimal instrument complex to support ecological security for every level in the economic systems. Its use in the activity of international establishments and organizations, state borders or regional administration allows to optimize processes to provide ecological security at different levels and also to avoid inefficient expenses.

Conclusions and perspectives for further studies. Integral results of the conducted research is to improve conceptual positions of theory and methodology to control ecological security in economic systems. The use of methodic approach to control global economic system ecological security, suggested by authors, allows to

increase reasonability of conclusions about ecological and economic optimality concerning the marketing instruments, to optimize processes to provide ecological security at various levels, and also to avoid inefficient expenses and to increase level of the ecological security in the world. Besides, the investigated scientific and methodic approach to determine marketing tools potential, based on market segments dynamic factors, distinguished by the ecological compatibility in behavior, interests and consumers' needs, and consumers' reaction index on the marketing tools, allows reasonably to choose marketing instruments for various market segments and to increase efficiency to control economic system ecological security. Practical value of the received results consists in the fact that owing to the suggested scientific and methodic approach to estimate synchrony of the mentioned processes, one may increase efficiency to control economic systems development in the system of sustainable development.

Thus, positions, formed by authors, allow to develop theoretical and methodic approach to through management of the global economic system ecological system in further studies.

References

1. Dany`ly`shy`n, B.M., & Stepanenko, A.V., & Ral`chuk, O.M. (2008). Bezpeka regioniv Ukrayiny` i strategiya yiyi garantuvannya. Pry`rodno-texnogenna (ekologichna) bezpeka [Ukrain's Regions Security and Strategy to guarantee it]. Ky`yiv, Ukrayina: Naukova dumka. [in Ukrainian]
2. Gorbulin, V.P., & Kachy`ns`ky`j, A.B.(2009). Zasady` nacional`noyi bezpeky` Ukrayiny` [Fundamentals of National Security of Ukrain]. Ky`yiv, Ukrayina: Intertexnologiya. [in Ukrainian]
3. Shevchuk, V. Ya., & Satalkin, Yu. M., & Bilyavs`ky`j, G. O. (2004). Ekologichne upravlinnya [Environmental management]. Ky`yiv, Ukrayina: Ly`bid`. [in Ukrainian]
4. Kuchmijov, A.V. (2014). Upravlinnya ekologichnoyu bezpekoyu ekonomichny`x sy`stem na zasadax markety`ngu. [Ecological safety management of economic systems based on marketing principles]. *Extended abstract of candidate's thesis. Sumy: SumSU* [in Ukrainian]
5. Shkola, V.Yu., & Prokopenko, O.V., & Domashenko, M.D., & Troyan, M.Yu., & Kuchmijov, A.V. (2014). Metody`chny`j pidxid do vy`boru instrumentiv zabezpechennya ekologichnoyi bezpeky` ekonomichnoyi sy`stemy` [Methodic approach to choose tools ensuring economic system environmental security]. *Markety`ngovi aspekty` upravlinnya innovacijny`m rozvy`tkom. – Marketing issues of innovation development management.* Sumy`, Ukrayina: TOV «Drukars`ky`j dim «Papirus», (pp. 403-417) [in Ukrainian]
6. Prokopenko, O. V., & Shkola, V. Yu., & Domashenko, M. D., & Troian, M. Yu. (2015). Modelling of the processes synchronized dealing with ecological safety within economic system. *Economic Processes Management: International Scientific E-Journal*, 2. Retrieved from: http://epm.fem.sumdu.edu.ua/download/2015_2/2015_2_24.pdf [in English]
7. Prokopenko O.V. (2008). *Ekologizaciya innovacijnoyi diyal`nosti: moty`vacijny`j pidxid [Ecologization of innovation activity: motivation approach]*. Sumy`, Ukrayina: Universy`tets`ka kny`ga. [in Ukrainian]
8. Ximich, O. (2002). Ekologichna bezpeka yak element nacional`noyi bezpeky` [Ecological Security as constituent of national security]. *Pravo Ukrayiny` – Low of Ukrain*, 11, 44-48. [in Ukrainian]

9. Xloby`stov, Ye. V. (2005). Problemy` zabezpechennya ekologichnoyi bezpeky` v umovax transformaciyi ekonomiky` Ukrayiny` [Problems to provide environmental security in the conditions of economic transformation in Ukrain]. *Extended abstract of Doctor's thesis. Kyiv: CSPFU*. [in Ukrainian]

10. Shkola, V.Yu. (2008). Ekonomichni osnovy` prognozuvannya zhy`ttyevogo cy`klu ekologichny`x innovacij. [Economic Fundamentals of Ecological Innovations Life Cycle forecasting]. *Extended abstract of candidate's thesis. Sumy: SumSU* [in Ukrainian]

11. Shmandij, V.M. (2004). Upravlinnya ekologichnoyu bezpekoyu na regional`nomu rivni (teorety`chni ta prakty`chni aspekty`) [Environmental Security Management at the Region Level (Theoretical and Practical Aspect)]. *Extended abstract of Doctor's thesis. Kharkiv: USRIEP*. [in Ukrainian]

12. Danilova-Daniliana, V.I. (Eds). (1997). *Ekologiia, ohrana prirody i ekologicheskaia bezopasnost [Ecology, nature protection and ecological security]*. Moskva, Rossiia.: Izdatelstvo MNEPU. [in Russian]

,