UDC 504.06

SCIENTIFIC FRAMEWORK OF INTEGRATED ESTIMATION OF RESOURCE AND ENVIRONMENTAL SAFETY MANAGEMENT TAKING INTO ACCOUNT REGIONAL FEATURES

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В статті розроблено та науково обґрунтовано теоретико-методологічний підхід щодо оцінки рівня ресурсно-екологічної безпеки регіонів у системі сталого розвитку, який полягає в розрахунку трикомпонентного показника, що враховує рівень екологічної безпеки економіки регіону, рівень екологічного ризику здоров'ю населення на основі апріорного вибору моделі, що відображає різні взаємозалежності в системі відносин «людина-середовище», та рівень ресурсозбереження і ресурсовідновлення у регіоні. Методологічною основою дослідження стали результати фундаментальних і прикладних досліджень у галузі фізичної економіки, екологічної економіки, положення концепції сталого розвитку. Отримані результати дослідження дозволили сформувати концептуальні засади забезпечення ресурсно-екологічної безпеки регіонів України, орієнтованих на підвищення ефективності використання природно-економічного потенціалу території, ресурсозбереження та ресурсозаміщення.

Ключові слова: *ресурсно-екологічна безпека, регіон, вторинні ресурси, тверді відходи.*

The problem of ensuring resource and environmental safety and more efficient use of natural and economic potential of the area is a priority for each region of Ukraine. According to the natural resource intensity index, which is an integrated indicator of energy and water consumption and airborne emissions hazard, etc. (for Ukraine it makes 8.7), Ukraine is ahead of such countries as Russia, Moldova, Poland and EU-members (this index is equal to 1.0 worldwide) [1]. At the same time, formation of an efficient market economy in the regions requires solution of the problems between the goals of the social and economic system development and negative effects of its impact on the environment considering the influence of destabilizing factors. In this aspect, forming new comprehensive approaches to ensuring resource and environmental safety in the region and creating strategies for improving primary and secondary resources management based on economic models and mechanisms are becoming a priority in regional development.

B. Burkynskyi, V. Stepanov, S. Kharychkov [2], V. Voloshyn, V. Trehobchuk [3], B. Danylyshyn, A. Stepanenko [4], and other specialists have made a great contribution to the development of theoretical and methodological

framework of a balanced development of the regions. The works of V. Vernadskyi, A. Klymenko, L. Melnyk, J. Odum, S. Podolinskyi, N. Reimers, M. Rudenko, J. Forester and other scientists are dedicated to fundamental studies of interaction between a society and nature. At the same time, the issues for further scientific research still involve a problem of forming comprehensive approaches to ensure resource and environmental safety of the regions. These approaches are based on developing an innovative methodology for regional social and economic system development, that ensures prevention of ecosystems and human health deterioration while improving social and economic conditions of a given system through a mechanism of more efficient use of natural and economic potential of the area.

Research methodology. The aim of our research was to develop and to scientifically substantiate theoretical and methodological approach in relation to the estimation of resource-ecological safety in the regions, on the basis of that to form conceptual principles of providing of resource-ecological safety in the regions of Ukraine, oriented to the increase of efficiency of the territory naturally-economic potential use on the basis of solid wastes capitalization and minimization of their negative influence. Modern society characterized by contradiction of two interrelated processes - economic growth and limited assimilation properties biosphere. It can be noted that the previous conceptual basis of the economy and development of society exhausted, and the use of traditional methods to achieve the objectives unacceptable in solving new problems environmental protection, which requires a paradigm shift in social development in eco-oriented, resulting in has become harmonious, environmentally sound socio-economic development and conservation of environmental quality and natural resources. In this context methodological research on resource and environmental safety should be multidisciplinary and include elements of the theory that define the purpose of applied research: systemic, synergistic, strategic, targeted, value and functional approaches; dialectical and metaphysical methods of learning, the cyclical nature of nature and society.

Результати досліджень. Resource and environmental safety of the region is a state of a regional natural and social and economic system that ensures prevention of ecosystems and human health deterioration while improving social and economic conditions of a given system (minimum entropy) considering the influence of destabilizing resource and environmental hazards of external and internal environments through a mechanism of more efficient use of natural and economic potential of the area, which is focused on resource preservation and substitution.

According to the theory of ecosystems safety and taking into account the influence of social and economic factors thereon [5, C. 51], a theoretical and methodological approach to assessing the level of the resource and environmental safety of the regions has been developed. This approach is to calculate a three-component index that takes into account a level of environmental safety of the region's economy (*P*), a level of environmental risk to the health of population (*M*) and a level of resource preservation and resource restoration in the region (*W*):

$$K = f(P, M, W), \qquad (1)$$

$P, M, W \to 1$, if $P, S, W \geq P_{suff}, S_{suff}, W_{suff}$

$P, M, W \to 0$, if $P, S, W < P_{suff}, S_{suff}, W_{suff}$

where $P_{suff}, M_{suff}, W_{suff}$ – sufficient value of indexes P, M, W.

Constituents of three-component index in relation to resource-ecological strength of region security it is suggested to determine so:

1) Index of ecological safety of region economy settles accounts as a total economic loss for contamination of environment from the technogenic loading in a region on authorial methodology [6, C. 72], the results of calculation of that allowed to define near-term strategy to direction of improvement of the system ecologically safe development in Ukraine regions (table 1).

2) The estimation of risk to the health of population it maybe to carry out by means of authorial model that represents different to interdependence in the system of relations "man-environment":

$$\begin{cases} M = 6{,}43 + 32{,}41\widetilde{W} - 0{,}173D + 0{,}604P \\ P = 41{,}29 + 14{,}43\tilde{A} + 15{,}49\tilde{G} - 1{,}28C \\ C = 39{,}65 + 1{,}735M \end{cases} \qquad (2)$$

Table 1. Grouping of Ukraine regions to direction of improvement of the system ecologically safe development of regions of Ukraine *

Type		***Regions***	***Near-term strategy***
Type A	A_1	Ivano-Frankivsk, Kyiv, Vinnytsya to the area	Effective strategy of guard of atmospheric air
	A_2	Crimea, Lviv, Mykolaiv, Odesa, Kherson, Tcherkasy to the area, Kyiv and Sevastopol	Effective strategy of guard of water resources
	A_3	Zhytomyr, Poltava, Рівенська, Sumy, Volyn to the area	Effective strategy of guard of soils
	A_1A_2	Dnepropetrovsk, Donetsk, Zaporizhzhya, Luhansk of area	Effective strategy of guard of atmosphere and water resources
	A_2A_3	Chernihiv area	Effective strategy of guard of water resources and soils
	$A_1A_2A_3$	Kharkiv area	Effective strategy of guard of atmospheric air, water resources and soils
Type B		Zakarpattia, Ternopil, Khmelnytsk, Chernivtsi, Kirovohrad to the area	Effective strategy of improvement of the system of health protection

* - *it is made authors.*

In this equalization the index of morbidity of population (M), as a basic indicator of ecological risk, is examined as a function from social-ecological-economic factors that have direct influence on a health of population: influence of contamination of the ground cover ($\widetilde{W}$), as sources of food products, degree of

satisfaction of requirements in services of health protection (*D*) and level of ecological danger of regional economy (*P*). The level of ecological danger of regional economy (*P*) is conditioned by social-ecological factors, namely by side effects from the production of contamination of atmosphere ($\widetilde{A}$) and hydrosphere ($\widetilde{G}$), by the level of "social trouble" in the region (*C*), determining from one side potential possibilities on the improvement of environment, and from other side it is observed to circulating connection: level of morbidity (*M*) in much why determines the level of "social trouble" in a region, so as higher morbidity provokes the greater amount of the lost working days and worsening of material terms. On the basis of economic-mathematical model (2) conducted estimation of ecological risk in the regions of Ukraine. The worst indexes of ecological risk are in those areas, where many industrial enterprises and minerals (Donetsk, Dnepropetrovsk, Zaporizhzhya and Ivano-Frankivsk areas) (figure 1).

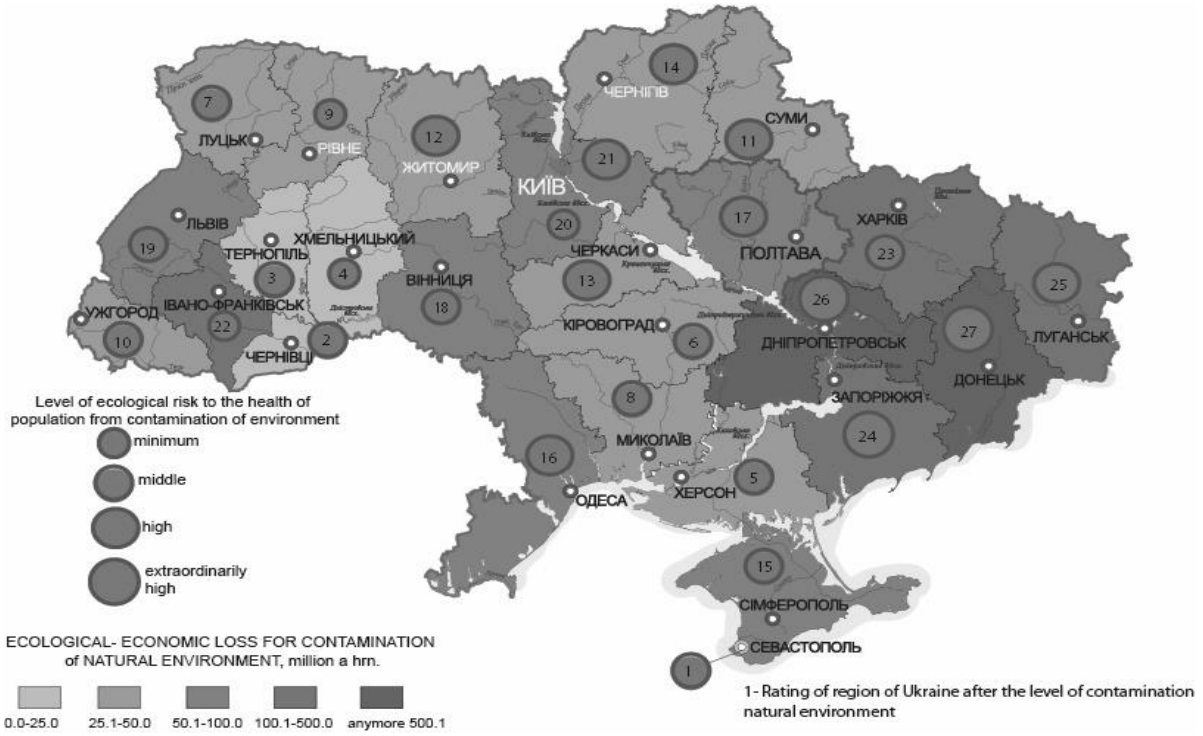

Figure 1. Estimation of ecological risk after to the regions of Ukraine, generalized data for 2005 - 2015 (it is made authors)

3) Index of level of proceeding in resources in the region includes next constituents: power-hungryness of solid wastes handling sphere in the region [8, C. 152]; economic efficiency of the use of secondary resources in a region [9, C. 210]; economic efficiency of the use of biopower potential in a region [7, C. 59]; an estimation of risk of health of population from the existent system of solid wastes handling [10, C. 242].

Eight values of three-component index of estimation of resource-ecological strength of region *K* security are possible in theory, that answer 4 zones of resource-ecological safety of region, presented on figure 2.

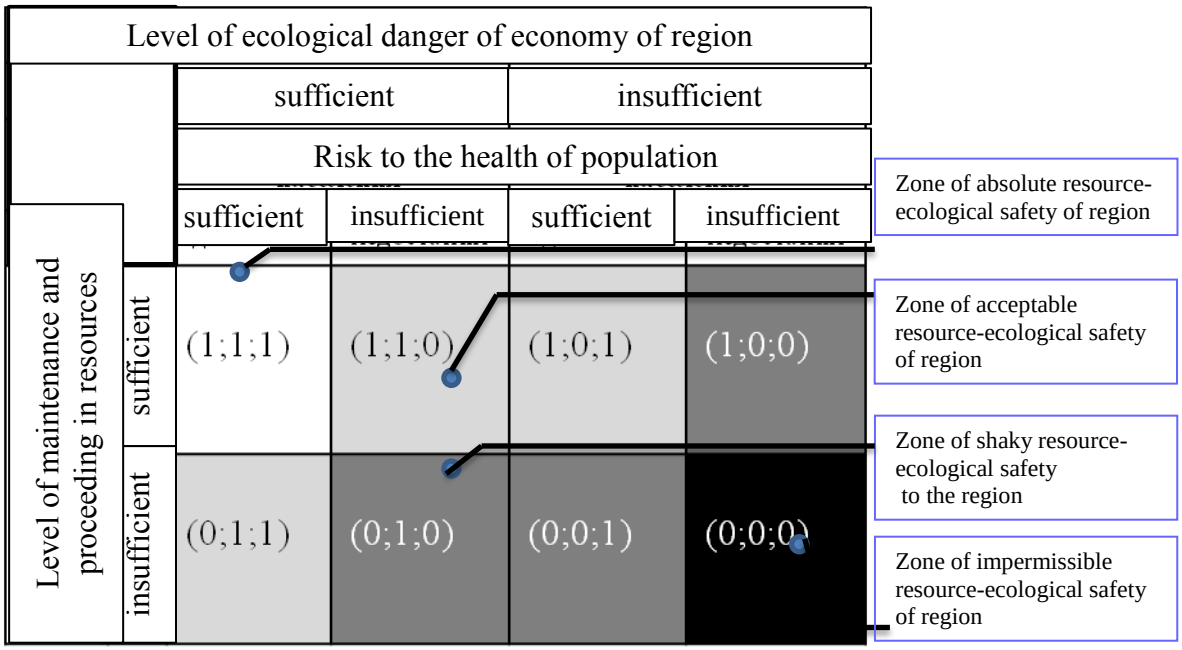

Figure 2. Zones of resource-ecological safety of region (it is made authors)

A study of the above stated indexes makes it possible to determine areas of the resource and environmental safety of the regions of Ukraine, and 16 regions belong to the areas of fragile and unacceptable resource and environmental safety (Fig. 3). The worst indexes of environmental risk are characteristic for regions where many industrial enterprises are situated and mineral resources are mined (Donetsk, Dnipropetrovsk, Zaporizhzhia and Ivano-Frankivsk regions). Only three regions have a level of resource preservation and resource restoration that is above average (Donetsk, Dnipropetrovsk and Zhytomyr regions).

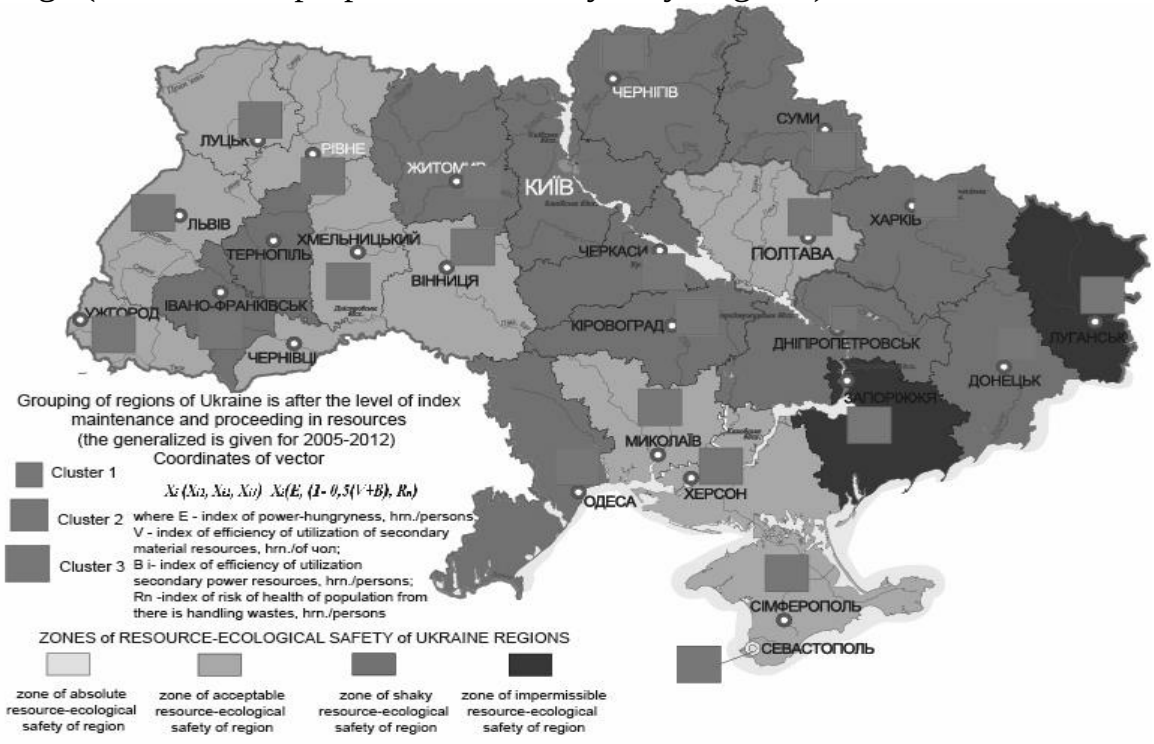

Figure 3. Grouping of Ukraine regions after resource-ecological strength, the generalized is given for 2005-2015 (it is made authors)

Coming from resulted, the complex going is formed near providing of resource-ecological safety of region that must include next constituents authentication of danger and determination of zones of resource-ecological safety; scientifically-methodical principles of choice of events of providing of sufficient economic strength security are on the basis of optimization economic models; adjustment and concordance of decisions are on the basis of integral model of development of the economical-ecological systems of the use of naturally-economic potential of region (figure 4).

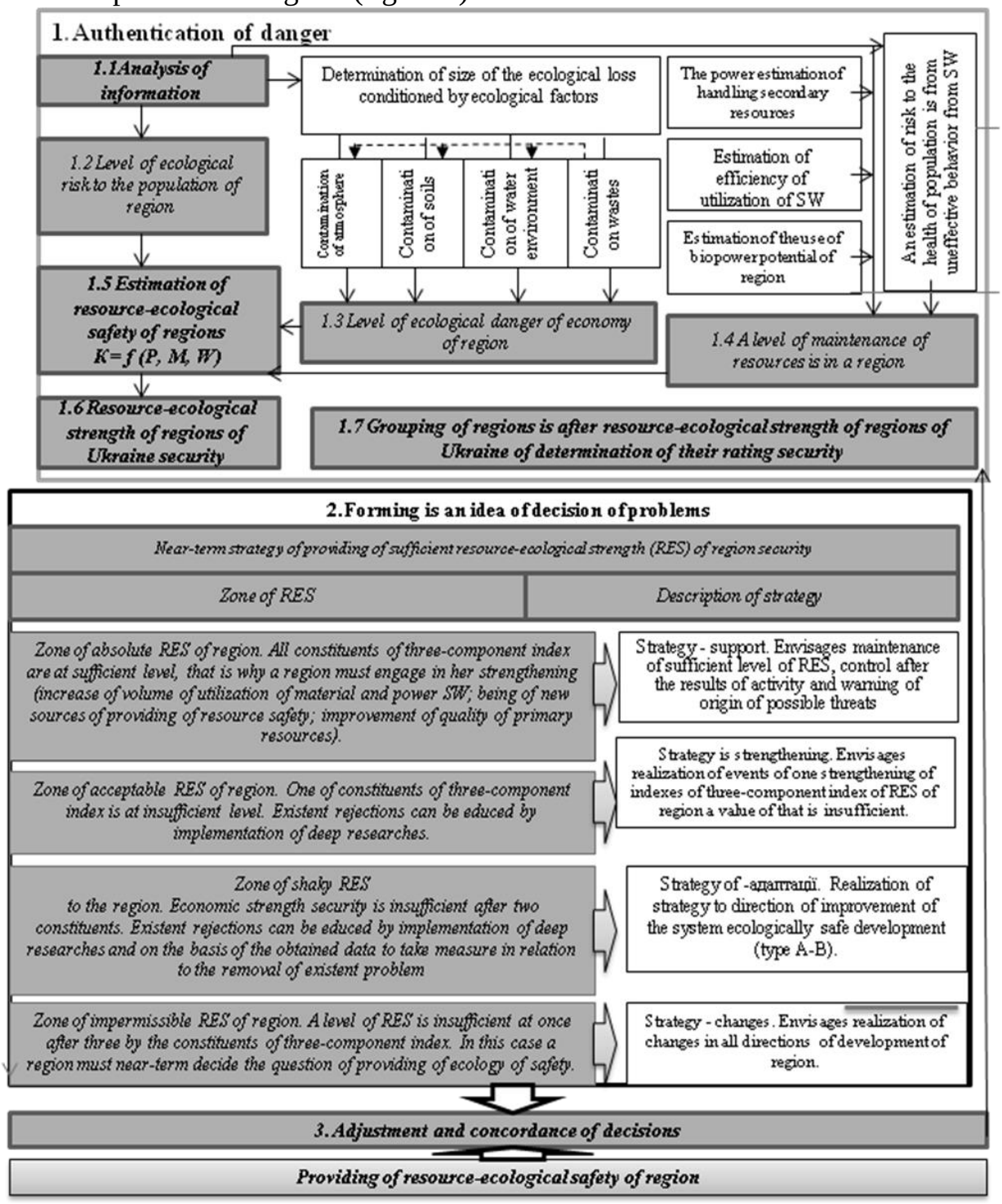

Figure 4. Methodological principles of providing of resource-ecological safety (RES) in the region (it is made author)

Conclusions. In the article theory-methodological approach is worked out in relation to the estimation of resource-ecological safety in the regions, that consists in the calculation of three-component index that takes into account ecological strength of regional economy, level of ecological risk on the basis of a priori choice of model of relations "man-environment", and level resources proceeding in the region. The results of research allowed to form conceptual principles of providing of resource-ecological safety in the regions of Ukraine, that must include next constituents authentication of danger and determination of zones of resource-ecological safety; scientifically-methodical principles of choice of events of providing of sufficient economic strength security are on the basis of optimization economic models; adjustment and concordance of decisions are on the basis of integral model of development of the economical-ecological systems of the use of naturally-economic potential of region.

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Одержано 07.03.2017

Аннотация

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Научные основы комплексной оценки эффективности управления ресурсно-экологической безопасностью с учетом региональных особенностей.

Проблема обеспечения ресурсно-экологической безопасности, повышения эффективности использования естественно-экономического потенциала территории является одной из приоритетных для каждого региона Украины. Поэтому в статье разработано и научно обоснованно теоретико-методологический подход к оценке уровня

ресурсно-экологической безопасности регионов в системе устойчивого развития, который заключается в расчете трехкомпонентного показателя и учитывает уровень экологической безопасности экономики региона, уровень экологического риска здоровью населения на основе априорного выбора модели, которая отображает разные взаимозависимости в системе отношений "человек-среда", и уровень ресурсосбережения и ресурсозамещение в регионе. Методологической основой исследования стали результаты фундаментальных и прикладных исследований в отрасли физической экономики, экологической экономики, положение концепции устойчивого развития. Полученные результаты исследования позволили сформировать концептуальные принципы обеспечения ресурсно-экологической безопасности регионов Украины, ориентированных на повышение эффективности использования естественно-экономического потенциала территории, ресурсосбережения и ресурсозамещение на основе капитализации твердых отходов и минимизации их негативного влияния. Полученные результаты исследования позволили сформировать концептуальные принципы обеспечения ресурсно-экологической безопасности регионов Украины, ориентированных на ресурсосбережение и повышение эффективности использования естественно-экономического потенциала территории. Практическая значимость работы заключается в оптимизации стратегии обеспечения ресурсно-экологической безопасности в регионе, реализация которой позволит: улучшить конкурентоспособность региона; получить дополнительный доход от вторресурсов; сохранить первичные ресурсы и улучшить их качество; уменьшить риск здоровью населения от негативного влияния отходов; обеспечить сохранение и возобновление окружающей естественной среды региона, естественного состояния экосистем.

Ключевые слова: *ресурсно-экологическая безопасность, регион, вторичные ресурсы, твердые отходы.*

Annotation

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Scientific framework of integrated estimation of resource and environmental safety management, taking into account regional features. *A problem of providing of resource-ecological safety, increase of efficiency of the naturally-economic potential use of territory is one of priority for every region of Ukraine. Therefore in the article it is worked out and scientifically reasonable methodological principles of estimation of resource-ecological safety in the region. It consists in the calculation of three-component index that takes into account ecological safety of regional economy, level of ecological risk on the basis of a priori choice of model of relations "man-environment", and level resources proceeding in the region. The methodological basis of the study were the results of basic and applied research in the field of physical economy, ecological economics, of the concept of sustainable development. The results of research allowed to form conceptual principles of providing of resource-ecological safety in the regions of Ukraine, oriented to the increase of efficiency of territory naturally-economic potential use on the basis of solid wastes capitalization and minimization of their negative influence. Practical meaningfulness of work consists in optimization of strategy of providing of resource-ecological safety in a region, realization of that will allow: to improve competitiveness of region; to get an additional profit from secondary resources; to save primary resources and improve their quality; to turn muddy earth in economic turnover of region; to decrease a risk to the health of population from negative influence of wastes; to provide maintenance and proceeding in the natural environment of region.*

Key words: *resource-ecological safety, region, secondary resources, solid wastes.*