SELECTION OF PROTECTIVE ACTIONS AND SOLUTIONS IN THE MANAGEMENT OF ENVIRONMENTAL SECURITY

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Abstract: An analytical apparatus and procedure to justify the protective actions and decisions in the management of cross-border environmental security is proposed. The approval is in justifying the managerial actions in the border region of Bulgaria. It proves its efficiency and reliability. Ways for searching of optimal protective actions are justified. An areas of possible management actions are defined. For a selection of protective actions a criterion of effectiveness is introduced. There are rules for making decisions to protect the border environment offered.
Key words: environment, security, management, selection, decisions.

The purpose of this work is to propose an analytical apparatus and procedure to justify protective actions and decisions in the management of cross-border environmental security. The problems to solve are: 1. Identifying the areas of possible management actions; 2. Choosing a way to search for optimum performance on environmental security in border areas; 3. Selection of decisions on protective actions in the environmental security of the border environment.

In the management of cross-border environmental security the searcing of possible alternative actions for the protection of environmental impacts, impact assessment and selection of optimal management action plays a basic role. The selection of possible alternatives requires identification of areas of existence of multitudes of management actions D_{φ} that contain optimum actions φ_0^*. This requires to establish quasi-optimal alternative areas $D_{\varphi_i} \supset D_{\varphi_0}$. Formally, the selection of protective action is defined as the extrapolation of indefinite area of demand. In this case, one can explore a finite multitude D_{φ} of possible areas of searching for the optimal protective action, that can be expressed as: $D_{\varphi} = \{D_{\varphi 1}, D_{\varphi 2}, ..., D_{\varphi n}\}$. It is assumed that the field contains the optimal action, as $\varphi_0 \in D_{\varphi_0} \subset D_{\varphi_i} \subset D_{\varphi}$. This expression is a condition to select the optimum protective effect. The ability to define the scope of protective measures D_{φ_i}, satisfying the condition of feasibility does not require proof. There are methods and tools for environmental protection which are verified and tested.

Our studies [1,2] show that can be applied two ways: 1. Requirement for the searching of protective action initially to be made in a wider area D_{φ} which gradually narrows until it comes to concrete protection matching the optimum. 2. The multitude D_{φ} of the protective actions must gradually expand until it reaches the optimum D_{φ_i} which is feasible and can be realized. The disclosure of the optimum field of action D_{φ_0} in the multitude D_{φ_i} can be defined in specific conditions and relationships that depend

on the nature of the problem in cross-border environmental security. It is meant the finance, human resources, political support, regional policy, international trade and relations, and many other influencing factors.

Based on them it should be differentiated defensive line $\{\varphi_1,\varphi_2,...,\varphi_o\}\in D_{\varphi_i}$ built up, which is a prerequisite for finding the optimal actions. The practice leads to task for convergence of the process of seeking action in the multitude $\{\varphi_o\}=D_{\varphi_o}$ of the action's alternatives. The optimal field of actions D_{φ_o} is not large. It is appropriate to be in accordance with the procedure set out. To prove that it is possible to determine the optimal number of protective action in the field of possible actions must be met three conditions: The criterion for selection must be choosen and must be formulatedthe limitations that define the ultimate goal. The criterion for selection should reflect the protective management actions that are in the multitude D_{φ_i} . Protection aims must lead to reduce the effects of transboundary impacts. Therefore, selecting the criterion we use them as a starting point.

A criterion of "effectiveness" of the system E of cross-border impacts $S_{Crossimpact}$, which causes harmful effects on the objects from the environment of border areas [2] is introduced. Thus meets the proven our studies [1] structure of the integral dangrer. On the other hand, the effectiveness should be determined by the effects of randomly occurring changes in the properties of the system of transboundary impacts $S_{Crossimpact}$. It is necessary to use a representative probabilistic description. Our experience [1,2] demonstrate that sufficient and reliable universal characteristic is the mathematical expectation P_s of the occurrence of the current state of the system of cross-border environmental impacts $S_{Crossimpact}$ in random space D_s . The space D_s is not determined. It can be indiscrete or discrete in dependance on the conditions and circumstances of the operation of the system $S_{Crossimpact}$, respectively the situation which is subject to analysis and evaluation in environmental security. The claim is proved by the nature, properties and characteristics of logic in the subjective evaluation [3].

In this scenario, the effectiveness E can be represented by the function φ of the system of cross-border impacts $S_{Crossimpact}$ in state space D_s and the probabilistic characterization P_s . It takes into account the statistical nature of the state q , fulfilling the condition $D_s:\forall\varphi_i\in D_\varphi\longleftrightarrow E_i$, where D_φ is the area of managing subjective actions φ . Three main properties of the effectiveness E of the system of transboundary impacts are defining: a) Effectiveness E has a numerical meaning $\|E\|\equiv CE$ corresponding to each subspace in the sub-multitude $D_s^{(i)}$ in the state's space D_s ($D_s^{(i)}\subset D_s$). b) The numerical importance CE is finite, positive real numbers, i.e it is found in range range: $0 < CE < \infty$. c) The effectiveness is E an integrating value $E=\sum_i E_i$ as $D_s=\bigcup_i D_s^{(i)}$ and $D_s^{(i)}\cap D_s^{(j)}$ at $i\neq j$. E_i is a simple effectiveness, part

of the effectiveness E of the system for cross-border impacts $S_{Crossimpact}$. Due to the effects of its i th subsystem in the j th cycle of operation. In determining the E_i i th subsystem should be considered as a system that interacts with border impacts environment $ENVI_{Crossimpact}$ and other subsystems in $S_{Crossimpact}$. This will include subational border environmental dangre events $S_{Natevent}$ and borders environmentally danger events $S_{Transevent}$.

The number $\|E\|$ reflects the effectiveness E quantitatively. We are labeling it with CE that represents symbolically the criterion of effectiveness. Formally, the criterion CE is considered as an image of effectiveness of the system of cross-border impacts $S_{Crossimpact}$: $CE : E \to R^E$, where R^E is a numerical representation of the axis of effectiveness. Concequently two multitudes D_E and $D_{\|E\|}$ which are compact linear spaces are defined. The model reflecting the nature of interactions between the system of cross-border impacts $S_{Crossimpact}$ and the environmental system $ENVI_{Crossimpact}$ is completed and takes the form $\left|D_E, D_\varphi, D_s, P_s\right|$. The level of restrictions CE^* on the criteria of effectiveness CE for selection of protective action $D\varphi_i$ must be set: $CE \geq CE^*$. Information on the level of criteria CE_0 for selection of quasi-optimum, which sets out a possible alternative: $CE \geq CE_0$. These three conditions are subjective in nature and reflect a personal present to the managing entity, which analyzes, assesses cross-border environmental security and decide for protection. The area D_{φ_i} is the search space of possible alternatives $D_{\varphi\delta}$. It corresponds to the inequality $CE \geq CE^*$. In this area should be found an alternative point of optimum protective action φ_0 which corresponds to equality $CE(\varphi_0) = optimumCE$. Around the point φ_0 it is possible to fiond points of possible alternatives $D\varphi_\delta$ that fulfill the condition $D_{\varphi\delta} = \{\varphi_\delta : \rho(\varphi_\delta, \varphi_0) < \delta\}$, $\rho(\varphi_\delta, \varphi_0)$ is the distance between φ_0 and φ_δ in the field D_{φ_i}. With an intuitive search of the optimal protective effect there is a high degree of randomness [4]. Therefore there must to apply analytical and argumentative method of seeking protective action effectively. It can be assumed that it is likely $P(\varphi_k)$ to the correct approach to the optimal action $P(\varphi_k) \geq \alpha$, which is - greater than 0. This means that $\alpha \geq 0$ for any protective effect φ that is not in the field $D_{\varphi\delta}$. Generally it is always searched for little α where appropriate steps must be taken to and inadequate steps are rejected [2]. In this way, however, should increase the difference $CE(\varphi_1) - CE(\varphi_\delta)$. The inadequate steps of searching not cause displacement of the point φ_k. They increase the number of points and timing of demand. Those productions determine the existence of area D_{φ_i} of possible protective actions in which the function $f(\varphi_k)$ of the probability density at an

appropriate step in any search φ_k is greater than zero. Decisions in the management of cross-border environmental security we found is a selection of alternative protective action. In this scenario, any solution will be a number R of solutions that do can be defined as expressions of a multitude of possible protective measures: $R \longleftrightarrow D_{\varphi}$, $R_i \longleftrightarrow D_{\varphi i}$, $R_o \longleftrightarrow D_{\varphi_0}$, $D_{\varphi} = \{D_{\varphi 1}, D_{\varphi 2}, ..., D_{\varphi i}\}$, $R = \{R_1, R_2, ..., R_i\}$, $\varphi_0 \in D_{\varphi_0} \subset D_{\varphi i} \subset D_{\varphi}$, $R_{o_j} \longleftrightarrow \varphi_o$, where $j = 1,2,..., m$, R - many decisions defining the field of search for the subset of possible alternative protective actions D_{φ_0}, R_{o_j} - a solution corresponding to the optimal alternative protective action. The evaluation of alternatives of protective management actions may indicate that it arises from a multitude of possible states of the system of cross-border environmental security: $D_s = \{q_1, q_2, ..., q_n\} / g = g_j / q_k$, where q_i is any i th state of the cross-border environmental security, which is seen as i th capable result of these possible alternative actions adopted, $g(q_k)$ - function of the environment, to which is evaluatedthe environmental security. At each possible outcome corresponds a local evaluation of effectiveness $CE = CE(\varphi_i, q_k)$ and probability of occurrence p_k that is associated with the function of the environment. Local assessments are determined by the conditions of acceptance of decisions - deterministic terms, conditions or conditions of risk uncertainty. Each management alternative protective effect may be associated with a multiple of possible states of cross-border environmental security. Then the evaluation will be based on the criteria of effectiveness $CE(\varphi_i)$. It can be a criterion for selecting a solution, firstly, and on the other hand to be admitted to a local criterion for evaluation. The choice of an alternative solution from the multitude of possible protective actions should be made rationally and efficiently. According to R. Lyyus and H. Rife [5], the rational decisions must be consistent, targeted and transitive.

Introducing these properties for solutions in the management of cross-border environmental security it is reached the following evidence: 1. Consistency. When the criterion of effectiveness CE' of an alternative solution φ' is greater than the criterion CE'' of an alternative solution φ'' then it is not acceptable the decision φ'' to prefer after φ', or any short recording with the sign $>$ preferably will look like the inequality $\varphi'' > \varphi'$. 2. Focus. When the alternative solution φ' is greater than the alternative solution φ'' and φ' ис consistent with the purpose Z' of cross-border environmental security and φ'' of the purpose Z'' then $Z' > Z''$ or the goal is Z', it must be preferred against a target Z''. 3. Transitivity. When the alternatives $\varphi', \varphi'', \varphi'''$ are associated with the ratios $\varphi' > \varphi''$, $\varphi'' > \varphi'''$, then $\varphi' > \varphi'''$.

The accuracy and timeliness both determine the quality of decisions in the management of cross-border environmental security. The credibility is a criterion for the confidence measure of certainty to the adopted decision, a measure of confidence that

the actual outcome of environmental protection will correspond to the expected result. It should be noted that the accuracy depends on the quantity and quality of information upon which the decision shall be taken in the management of cross-border environmental security.The solutions for the cross border environmental security should be taken on time. Otherwise they contain outdated information and the undertaken decisions are not significant and reliable. The usefulness of the solutions is a function of time t. To assess the usefulness of the solutions in the management of cross-border environmental security we suggest the usage of the criterion of utility U Kozeletskiy [4]: $U(t)=1/(t^2-1)$ .The experience shows that a comparison of decisions by a simple alternativeness - two by two is most - safe and accessible. The preffered solutions are $\varphi_i > \varphi_j$. This method involves the minimum limitations in its usage. Moreover, the requirement for a transitive decisions drops. We believe it is appropriate and the method of pure dominance, in which all indicators of a decision must be greater than the performance of another solution. Depending on the nature of the compared results of protective actions there are four possible options: I variant: $\langle \varphi_i, \varphi_j \rangle \in Pr \longleftrightarrow \varphi_i > \varphi_j$. The protective action φ_i is preferred to action φ_j, II variant: $\langle \varphi_i, \varphi_j \rangle \in Pr^{-1} \longleftrightarrow \varphi_j > \varphi_i$. The action φ_j is preffered to action φ_i, III variant. $\langle \varphi_i, \varphi_j \rangle \in Pr \cup Pr^{-1} \longleftrightarrow \varphi_i \approx \varphi_j$. The action φ_i is equivalent to φ_j, IV variant. $\langle \varphi_i, \varphi_j \rangle \notin Pr \cup Pr^{-1} \longleftrightarrow \varphi_i \approx \varphi_j$. The action φ_i is incomparable with φ_j. In determining the preferences of ordinary pairs to the alternative solutions is applied a selection criterion, which is a function of the compared alternatives: $\varphi_i \to E(\varphi_i)$ and $\varphi_j \to E(\varphi_j)$.

In this case $E(\varphi_i)$ and $E(\varphi_j)$ and the effects of management protective actions φ_i and φ_j. The exact preference for a solution is shown by the expression $\langle \varphi_i, \varphi_j \rangle \in P \longleftrightarrow E(\varphi_i) > E(\varphi_j)$, And the approximate preference by: $\langle \varphi_i, \varphi_j \rangle \in P \longleftrightarrow E(\varphi_i) \geq E(\varphi_j)$. The effects and corresponding alternative protective actions $E(\varphi_i)$ and $E(\varphi_j)$ can be both quantitative and qualitative. They should be adopted subjective - personally, alone or in team of experts on the basis of perceived preference. The preference's property γ we believe is appropriate to be determined by the ratio $\frac{E(\varphi_i)}{E(\varphi_j)} = \gamma$ or the difference $E(\varphi_i) - E(\varphi_j) = \gamma$. Applying these two estimates should not affect the preference because the solution taking principle is basic. According to the awareness the assessments based on the effects $E(\varphi_i), E(\varphi_j)$ and effectiveness $CE(\varphi_i), CE(\varphi_j)$ criteria should be subject to the ratio $E(\varphi_i) > E(\varphi_j) \longleftrightarrow CE(\varphi_i) > CE(\varphi_j)$. The ratio is a consequence of the above interpretations of the effectiveness $E(\varphi)$ of the transition to the criterion of

effectiveness $CE(\varphi)$. The awareness principle imposes restrictions on the nature of the assessments of the preferences of the decision.

In the case of the basis of assessments by the criterion of effect $E(\varphi_i)$ and effectiveness $CE(\varphi_i)$ respectively $E(\varphi_j)$ and $CE(\varphi_j)$, the preference $\varphi_i > \varphi_j$ is accepted, then $\sum_{k=1}^{n} E_k(\varphi_i) > \sum_{r=1}^{m} E_r(\varphi_j)$. The expression is consider the compare of the estimates the un-averaged effects assessments.

In accordance with the principle of awareness at the the transition between the evaluations E and the criteria CE it is led to the inequality $\sum_{k=1}^{n} [\alpha E_k(\varphi_i) + l] > \sum_{r=1}^{m} [\alpha E_r(\varphi_j) + l]$, which takes the following transformations $\alpha \sum_{k=1}^{n} E_k(\varphi_i) + nl > \alpha \sum_{r=1}^{m} E_r(\varphi_j) + ml$, $\sum_{k=1}^{n} E_k(\varphi_i) + \frac{(n-m)}{\alpha} l > \sum_{r=1}^{m} E_r(\varphi_j)$.

An analytical system and procedure to justify the protective actions and decisions in the management of cross-border environmental security is proposed and approbated. It shows its effectiveness and credibility. To achieve the objective of this study, some argue ways to search for optimal protective actions in the protection of cross-border environment are shown. The areas of possible management actions were defined.

The selection of protective action is done by the introduced criterion of effectiveness, which reflects the results of any transboundary impacts. The operating conditions of the system of cross-border effects are random and they are determined by a probabilistic description.

Solutions in the management of cross-border environmental security are considered as a selection of alternative protective action selected from at least two actions. There are characteristics that determine the usefulness of rationality and decision making. A binary choice of two by two actions is made. Some rules were defined, which are the essential for management of environmental security.

References

1. Vladimirov, L. Riskmetrics in environmental security. Monograph. Varna: Varna Free University. 2009.
2. Vladimirov, L. Theory of the cross-border environmental security. Monograph. Varna: Varna Free University. 2012.
3. Ивин, А. Основания логики оценок. Москва, Издателство Московкого государственного университета, 1990.
4. Козелецкий, Ю. Психологическая теория решений. Москва, Прогрес, 1989.
5. Льюс, Р., Х. Райфа. Игры и решения. Москва, Инностранная литература, 1981.