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METHODOLOGICAL APPARATUS FOR TIMELY DETECTION OF BORDER MANAGEMENT THREATS IN THE SYSTEM OF THE NATIONAL SECURITY OF THE STATE

The article addresses the authors' solution of a scientific problem concerning the development of a scientific and applied toolkit including a newly developed methodology and improved model, indicators, and criteria. The original set aims at enhancing the effectiveness of the threat prevention system in the border security sector through interaction with actors of the national interest protection system.

A number of issues were raised such as ensuring timely threat prevention at both the national and international levels in terms of border management in the system of Ukraine's national security; choosing ways to improve the ability of implementing the functions of timely detection of threats posed to state security – these tasks are assigned to the national security system of the state based on a robust system of border management threat prevention.

A system of indicators and criteria was developed to facilitate a targeted search for the best (rational) choiceof making decisions on how to prevent and counteract threats posed to border management, and this alternative is supposed toconsider the level of threats, decrease in informational reliability of over time when preparing a decision on implementing protective and preventative measures against threats. The main task of applying the developed methodological apparatus is to enhance threat prevention efficacy for border managementthrough organizing information interaction with the actors of the system of state protection of the national interests.

Keywords: *state and national security, border security, law enforcement agencies, integrated border management, model, methodology, threats, risks, information and analytical activities, assessment, information.*

Statement of the problem. In the current climate, the achievement of the national interests of any country may at some point face an unpredictable crisis. The nature of its occurrence and possible consequences require immediate prevention or resolution of such a situation by a collegial body intended to analyze the state of affairs, propose possible ways out of the crisis and provide a vision of future prospects. In many countries, these tasks are assigned to anti-crisis structures, including situation centres and crisis centres.

Timely detection of escalation or aggravation of the situation increases the effectiveness of the system designed to prevent threats posed to the national security of the state in the sector of border management. The information collected from various sources [subordinate units, departmental databases of the State Border Guard Service of Ukraine (SBGS) and interacting law enforcement agencies, intelligence services, international law enforcement agencies and intelligence services of partner countries, etc.] is used to indicate the aggravation in accordance with the current legislation [1].

Thus, the strategic problem of ensuring border security in the context of potentialcrisis with migration dimensions is a challenge for the state. The consequences of its untimely solution may be vulnerability to real threats posed to national security in the field of protection and defence of the state border of Ukraine. A striking example of such a threat is the migrant crisis on the borders of Belarus with Poland, Lithuania and Latvia, artificially created by the aggressor state when thousands of illegal migrants were trying to break through the Polish border accompanied by the belarusian military. This circumstance required the top political leadership of Ukraine and the SBGS to make prompt changes to regulatory documents at both the state and departmental levels.

Structuring the strategic problem of border security related to a possible migration crisis is a fundamental issue of the strategic planning process in the field of national security. In this regard, before introducing new concepts, development strategies, state programmes and other strategic documents in the national security sector, which should be aimed at ensuring the implementation of the state policy in the field of state border protection, public authorities within their competence should assess the threats associated with a potentialcrisis with migration dimensions.

On 24 February 2022, the heroic resistance of Ukraine to the aggressive actions of the occupier and its supporters began. Since then, the number of heroic deeds of both military personnel and civilians of Ukraine has become incalculable. The dynamic development of events from late February to early April 2022 prompted the military leadership of the state to make new decisions on conducting manoeuvre warfare, using available forces and means to effectively counter the occupiers.

From the very first days, the SBGSU implemented a set of measures to counter the military invasion of the agressor across the state border of Ukraine. After receiving relevant information about the shelling of checkpoints and places of permanent deployment of border guard departments and border guard detachments, decisions were made to organize surveillance of the enemy's actions (directions of movement of convoys of equipment and their number, nature of actions, etc.), organize retreats to reserve positions and set up fire ambushes and observation posts. The next step was the decision to "merge" the linear border guard units into the National Guard and the Armed Forces of Ukraine and then to perform the tasks assigned to the border guards by the military leadership of the defence forces. Separate mobilization measures were taken to form rapid response border commandant's offices, reserves of the Head of the Service and other units that reinforced the regular SBGS units.

Therefore, in order to make timely decisions that will be adequate to the situation, the headquarters of all levels of the State Border Guard Service of Ukraine regarding the protection of the state border, it is required to have multidimensional control objects for typical situations that may arise in the areas of responsibility of the SBGS units, a measurable indicator forlevels of aggravation and a methodology for performing calculations that allows to timely detect changes in the indicator, predict their nature and identify the period during which the state of aggravation may change.

Analysis of recent studies and publications. A significant scientific contribution to the study of problems coupled with ensuring the national security of Ukraine in the sector of border management, as well as to the development of scientific and methodological support for the protection and defense of the state border was made by such national scientists as V. P. Horodnov, M. M. Lytvyn, D. V. Ishchenko, V. A. Kyrylenko, S. O. Dmytrov, Yu. S. Palamarchuk, V. O. Balashov, R. H. Karataiev, O. A. Binkovskyi, O. V. Meiko, A. B. Mysyk, D. A. Kupriienko, and O. B. Farion. The works of A. A. Timchenko, R. E. Shannon, Yu. O. Ushenko, A. L. Nehrych focus on issues of system design, system modeling and system analysis of entities. The study of the above scientific researchpapers established that comprehensive exploration of the challenges to ensuring national security, in particular potential threats to border management, had not been carried out before. Neither was the solution of the scientific task on building a system of preventing threats to border management provided.

The purpose of the article is to substantiate the algorithm and methodology for building a system that willhelp prevent threats in the sector of border management with a view to further development of relevant recommendations for the entities that ensure the national security for the state.

Summary of the main material. There are two ways of building models. The first method suggests that a thorough study of the system leads to the establishment of laws according to which the system will function. These laws will then be reproduced through the model.

In general, the current situation is characterised by a set of heterogeneous indicators and can be represented as a well-known category of "multidimensional object". The availability of relevant heterogeneous information determines the need to assess the degree of aggreviation as an integral indicator of a multidimensional object that has heterogeneous numerical and other indicators with a known direction of their impact on the state of the entity and, possibly, with an unknown functional relationship of the indicators.

Variants for combinations of aggravation indicators are multidimensional. This enables using the approach known in taxonomy to assess multidimensional units by refining the idea of measuring taxonomic distance and considering the specifics of assessing the level of aggravation and its transition to the level of threat.

In taxonomy, the main concept is the taxonomic distance, which is the distance between n-dimensional unitsin the Euclidean n-dimensional space. The initial stage of data preprocessing is the formation of an observation matrix X_{mn} of dimensionality ($m \times n$) with the values of all n-th indicators of a particular i-unit recorded in each row:

$$X_i = (x_{i1}, x_{i2}, ..., x_{in}), \qquad i = \overline{1, m}.$$

In this case, a separate set (vector X_0) of the threat status indicators is formed by experts or taken from historical data. It is a list of typical values of indicators that characterise the threat status in the border area. This vector is recorded in the first row of the observation matrix X_{mn}. The observation matrix X_{mn} contains the most complete characteristic of the population of multidimensional unitsunder study and has the following form:

$$X_{mn} = \begin{pmatrix} X_1 \\ X_2 \\ \cdots \\ X_i \\ \cdots \\ X_m \end{pmatrix} = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{in} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mj} & \cdots & x_{mn} \end{pmatrix}, \qquad (1)$$

where m is the number of units (points of n-dimensional space); n is the number of indicators for each statistical unit; x_{ij} is the value of the j-th indicator in the i-th unit.

The indicators in matrix (1) describe different properties of the environment, have different dimensions, and therefore cannot be compared with each other. Thus, the first step is to standardize the indicators:

$$z_{ij} = \frac{x_{ij} - m_j}{\sigma_j}, \quad i = 1, ..., m; \quad j = 1, ..., n, \qquad (2)$$

where $\bar{x}_j = m_j = \frac{1}{m}\sum_{i=1}^{m} x_{ij}, \quad j = 1, ..., n;$

$$\sigma_j = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(x_{ij} - m_j)^2}, \quad j = 1, ..., n.$$

The conversion of each x_{ij} value for the j-th indicator according to the formula (2) yields the equivalent matrix Z_{mn}:

$$Z_{mn} = \begin{pmatrix} Z_1 \\ Z_2 \\ \cdots \\ Z_i \\ \cdots \\ Z_m \end{pmatrix} = \begin{pmatrix} z_{11} & z_{12} & \cdots & z_{1j} & \cdots & z_{1n} \\ z_{21} & z_{22} & \cdots & z_{2j} & \cdots & z_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ z_{i1} & z_{i2} & \cdots & z_{ij} & \cdots & z_{in} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ z_{m1} & z_{m2} & \cdots & z_{mj} & \cdots & z_{mn} \end{pmatrix}. \qquad (3)$$

Next, it is necessary to calculate the distance c_{i0} from each i-th unit (points of the population under study) to the reference point (the vector of the boundary transition from the aggravation of a situation to the state of clear threat):

$$c_{i0} = \sqrt{\sum_{j=1}^{n}(z_{ij} - z_{0j})^2}, \qquad i = 1, 2, \ldots, m. \qquad (4)$$

The closer the unit (Z_i) of the population is to the reference point, the lower the value of c_{i0} becomes. However, the specific value of the distance does not provide an unambiguous characteristic for the degree of remoteness of the population unitfrom the reference point. More informative is the ratio of the distance c_{i0} to the maximum possible distance (c_0) in the population of multidimensional unitsunder study ($d_i^* = c_{i0}/c_0$). This ratio is within the range of $L_{si}^* \in [0; 1]$; it automatically reflects the degree of proximity of the i-th unit (point of the population under study) to the reference point. To move to the dimensionless indicator L_{si}, it is necessary to find a statistical estimate of the valuec_0. In this regard, the value of $M[c_{i0}]$ and σ_0 are first to be found:

$$M[c_{i0}] = \bar{c}_0 = \frac{1}{m}\sum_{i=1}^{m} c_{i0},$$

$$\sigma_0 = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(c_{i0} - \bar{c}_0)^2}. \qquad (5)$$

Then, the value c_0 is calculated:

$$c_0 = \bar{c}_0 + 3\sigma_0. \qquad (6)$$

In this case, the value c_0 can be used to convert to dimensionless distances (to the distance index) of each unit of the population from the reference point.

Then, for each *i*-unit (Z_i) of the population, it is necessary to find the value of the intermediate indicator for the aggravation level, i.e. the degree to which the current state of the situation complieswith the threatidicator, that is L^*_{si}:

$$L^*_{si} = \frac{c_{i0}}{c_0}. \quad (7)$$

Expression (7) provides the following interpretation of the values of the indicator: the smaller (the closer to zero) the value of the aggravation level indicator is for the *i*-th unit (Z_i), the closer the assessed point is to the reference one.

The opposite direction of change in the values of the indicator and the conclusions about the aggravation level is inconvenient, so for practical use, expression (7) should be changed to obtain the final formula for the indicator (L_{si}) of aggravation level:

$$L_{si.j} = 1 - \frac{c_{i.j0}}{c_{0.j}}; \quad 0 \le L_{si.j} \le 1 \cdot \quad (8)$$

The indicator is interpreted in the following way: the higher the value (L_{si}) of the aggravation level indicator is, the closer the current *i*-state of aggravation is to the reference situation of threat.

The fractional component characterizes the degree to which the current aggravation level in the multidimensional Euclidean space of actual threat signs is remote from the state when the threat fulfils oneself. For timely management of the situation parameters, it is necessary to have another indicator that is time ($t_{\text{threat.i.}j}$) remaining before the indicator $L_{si.j}(t)$ crosses the level of threat $L_{\text{threat.i.}j}$:

$$t_{\text{threat.i.}j} \approx \left[\left(a^2_{1.\text{i.}j} - 4a_{2.\text{i.}j}\left(a_{0.\text{i.}j} - L_{\text{threat.i.}j}\right)\right)^{0,5} - a_{1.\text{i.}j}\right] \times \left(2a_{2.\text{i.}j}\right)^{-1}. \quad (9)$$

The most relevant (*i*-th) direction of operational activity in the sector of border management can be chosen according to the criterion of the minimum time ($t_{\text{threat.i.}j}$) remaining before the indicator $L_{si.j}(t)$ crosses the level of actual threat $L_{\text{threat.i.}j}$

$$\arg\,(i, j) = \min_{i,j} \left(t_{\text{threat.i.}j}\right). \quad (10)$$

In this case, the calculated values for thethreat indicator of the *j*-th unit and directions will determine the urgency of decisions to counter the threat, which has the appropriate priority according to the time remaining before the threat enters the critical state of high risk occurrence.

Tables 1 to 4 present a summary scale of significant factors, parameters and indicators, groups of operational situation elements, significant operational situation data for making decisions on state border protection, a scale of data significance for threat assessment and risk analysis, groups of operational situation elements used in the analysis, preparation of general forecasts, formation of dynamic situation models and development of analytical reference materials.

The methods used in the course of the study areas follows: system analysis, mathematical modelling, and elimination. The latter involveseliminating the influence of all entities except that one the influence of which must be determined. The relevant indicators and evaluation criteria were formed, which made it possible to assess the quality of the final information on the current situation with border management threats [2].

The weighting coefficients were calculated through an expert survey of qualified specialists during the training and methodological meeting of deputy chiefs of staff of regional departments and state border guard agencies at the National Academy of the State Border Guard Service of Ukraine. Thirty-five specialists in the field of state border protection were involved as qualified experts. The expert group consisted of officers of the operational and tactical level, officers of the regional department headquarters and border guard detachment. No ranking of experts was carried out, as all the specialists were believed to have a sufficient level of professionalism corresponding to their positions [3].

The expressions arranged in the tablesabove build a formula model for the subsystem of implementing preventative measures against border management threats todesign the overall system.

Table 1 – Summary table of significant factors, parameters and indicators toperform calculations on the organization of state border protection

<table>
<tr><th colspan="2">Calculations required</th><th>Significant factors, parameters and indicators</th></tr>
<tr><td colspan="3">Identifying areas of focus for major efforts</td></tr>
<tr><td colspan="2">The complexity ratio for the operational environment in the i-th area of the border protection k_i:
$$\kappa_i = \sum_{i=1}^{n} c_i \quad K$$</td><td>c_i – the significance assessment for individual elements of the operational environment;
n – the number of elements of the operational environment in a particular area of border protection</td></tr>
<tr><td rowspan="2">Focus ratio for main efforts k_{ec}:
$$\kappa_{ec} = \frac{P_d^2}{P_p}$$</td><td>Calculation of the expected value of probability for the direction of concentration of the main efforts (P_d):
$$P_d = \sum_{i=1}^{x} P_i \cdot \frac{l_i}{l_p}$$</td><td>l_i – the length of the state border section protected in the i-th direction, km;
P_i – the probability of detection and detention for border violators on the i-th direction;
l_p – the total length of the state border plot protected on the i-th direction, km. It is determined separately for the assessment of P_d and for other directions when assessing P_p;
x – the number of border protection areas (units); it is determined separately during the assessment of P_d and for other plots when assessing P_d</td></tr>
<tr><td>Calculation of the expected value of probability for the direction of concentration of the main efforts (P_p):
$$P_p = \sum_{i=1}^{x} P_i \cdot \frac{l_i}{l_p}$$</td><td>P_d – calculation of the expected value of probability for the direction of concentration of the main efforts on other plots</td></tr>
<tr><td colspan="3">An analysis of the forceand equipment distribution for effectiveness by plots (directions) of state border protection</td></tr>
<tr><td colspan="2">The distribution of forces and equipment is assessed by calculating the ratio of concentration of the main efforts k_{ec}:
$$\kappa_{ec} = \frac{x_0^2}{x_p}$$</td><td>x_0 – the indicator to characterize the protection of the main plots (directions, areas). E.g.$x_0$can bethe probability of detecting and detaining border violators in the direction of concentration of main efforts, etc;
x_p – the indicator to characterize the coverage of other plots (directions, areas). For example, the probability of detecting and detaining border violators in other areas, etc.</td></tr>
<tr><td colspan="3">An example of a tactical assessment of the probability for state border violators to be detected and detained at the border guard detachment site</td></tr>
<tr><td colspan="2">Tactical assessment of the probability of detecting and detaining border violators (P_{ta}):
$$P_{TA} = \sum_{i=1}^{n} P_{ta(ibc)} \cdot \frac{l_{ibc}}{l_{sbc}}$$</td><td>P_o – the probability for border violators to be detected;
P_d – the probability for border violators to be detained if detected;
L_{ibc} – the length of the state border section protected by the i-th outpost, km;</td></tr>
</table>

<table>
<tr><th colspan="2">Calculations required</th><th>Significant factors, parameters and indicators</th></tr>
<tr><td colspan="2"></td><td>L_{sbc} – the length of the state border section protected by the outpost;
n − the number of outposts in the detachment;
$P_{ta(ibc)}$ – tactical assessment of the probability for border violators to be detected and detained by the i-th outpost</td></tr>
<tr><td colspan="2">The probability of detecting border violators on the i-th direction of protection (P_i):
$$P_i=\sum_{k=1}^{c}\left[1-\prod_{\gamma=1}^{x}(1-P_\gamma)\right]\cdot\frac{t_k}{24}$$</td><td>P_γ – the probability for border violatorsto be detected by the γ-th border patrol (technical means);
t_k – the time interval for which the probability P_γ = const, i. e. does not change abruptly, hour;
c – the number of time intervals t_k;
x – the number of border patrols and technical means to protect (control) the i-th direction</td></tr>
<tr><td colspan="3">Methodology of assessing the state border for effectiveness of itsprotection on international routes</td></tr>
<tr><td>The average wait time for a person, vehicle, cargo or other property to be admitted to the inspection at a checkpoint, t_{wt}:
$$t_{wt}=M_{wt}/\lambda$$</td><td>1. Average number of persons, vehicles, cargo or other property queuing to be inspected at a checkpoint (M_{wt}):
$$M_{wt}=\frac{\alpha P_n}{n\left(1-\alpha/n\right)^2}.$$
2. Probability for a person, vehicle, cargo or other property to wait for admission to the inspection at the checkpoint (probability that all BCPs are busy inspecting) (P_{wt}):
$$P_{wt}=\frac{\alpha^n P_n}{(n-1)!(n-\alpha)}.$$
3. Probability for a certain number of people, vehicles, cargo or other property to arrive at the BCP within one hour (P_κ):
$$P_\kappa=\lambda^\kappa\left(e^{-\lambda}/\kappa!\right).$$
4. P_n – probability that the number of persons, vehicles, cargo and other property undergoing and awaiting inspection is equal to the number of TIs:
$$P_n=\frac{\alpha^n}{n!}P_0$$</td><td>λ – the flow parameter, i. e. the average number of people, vehicles, cargo or other property entering the state border crossing points within one hour, units/hour;
t_{insp} – average time spent by a border patrol for inspection of one person, vehicle, unit of cargo or other property, hour;
n – number of border patrols, units;
P_n – the probability for the number of persons, vehicles, cargo and other property being inspected and waiting for inspection to be equal to the number of border patrols;
κ – the number of persons, vehicles, cargo or other property awaiting inspection;
P_0 – the probability of the absence of persons, vehicles, cargo or other property requiring passage across the state border at the checkpoint (the probability that all border patrols are free from inspection)</td></tr>
</table>

<table>
<tr><th colspan="2">Calculations required</th><th>Significant factors, parameters and indicators</th></tr>
<tr><td colspan="3">Calculation and analytical method to determine the parameters for organizing state border protection at the land section of the border outpost</td></tr>
<tr><td rowspan="2">To calculate the time for prevention of border violators from reaching the border protection line t_{prev}, min:
$T_{prev} = t_{intr}–t_{res}$</td><td>To calculate the time of the intruders' advancement from the point of the main engineering structures to the border protection line (t_{intr}, min):
$T_{intr} = 60 l_{rbpl}/V_{intr}+\Delta t_{intr}$</td><td>$l_{rbpl}$ – remoteness of the border protection line from the point of major engineering structures, km;
V_{intr} – maximum speed of border violators' advancement in the area between the border protection line and the point of the main engineering structures, km/h;
Δt_{intr} – time required for the border violator to overcome the border of the main engineering structures, min</td></tr>
<tr><td>To calculate the time of deployment of the border guard reserve to the border security line and organization of its service there(t_{res}, min.):
$T_{res} = 60(l_{fa}/V_{res}+ +l_{bcl}/V_{depl}) + \Delta t_{res}$</td><td>$L_{fa}$ – distance from the location of the border outpost to the border security line, km;
V_{depl} – speed of deployment of the border guard reserve at the border protection line, km/h;
V_{res} – speed of advancement of the border guard reserve to the border protection line, km/h;
L_{bcl} – the total length of the protected area along the border cover line;
Δt_{res} – delay time for the border guard reserve to reach the border security line, deploy and organize its service there, min</td></tr>
<tr><td colspan="2">To calculate the time for the alarm group to arrive at the place where the signs of border violation were detected (t_{rrt}, min):
$T_{rrt} = 60 l_{rrt}/V_{rrt}+ \Delta t_{rrt}$</td><td>$L_{rrt}$ – distance from the location of the border outpost to the place where the border violation signs were detected along the route of the rapid response team, km;
V_{rrt} – the speed of the alarm group's advancement to the place where the border violation signs were detected, km/h;
Δt_{rrt} – delay time for the rapid response team to reach the place where the border violation signs were detected, min</td></tr>
<tr><td colspan="2">To calculate the total length of the covered area along the border protected line (l_{pr}, km):
$L_{tas} \leq l_{pr} \geq (3 l_{rbpl}+ C)$</td><td>C – accuracy of determining the location where the border violator crossed the boundary of major engineering structures, km;
l_{rbpl} – remoteness of the border protection line from the border of the main engineering structures, km;
l_{tas} – length of the triggered alarm system section and two adjacent sections</td></tr>
</table>

Table 2 – Groups of the operational environmentelementsimportant for making decisions on the protection of the state border

<table>
<tr><th>No.</th><th>Constituent elements of the operational environment group</th></tr>
<tr><td colspan="2">Group 1The status, pattern and nature of the actions performed by state border violators</td></tr>
<tr><td>1</td><td>Armed provocations: a) repeated cases; b) isolated cases</td></tr>
<tr><td>2</td><td>For the neighboring territory (in border settlements), presence of persons engaged in smuggling activities and illegal migration</td></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>16</td><td>Resettlement of repatriates in the border area</td></tr>
</table>

No.	Constituent elements of the operational environment group
Group 2 The status, completion and capacitiesof the own force and equipment	
17	Occurrence of untargeted areas or areas not covered by alarm systems (with inoperable systems)
18	The overall assessment of the state of signaling equipment is "satisfactory"
19	Presence of units of the Armed Forces of Ukraine in the border area (near the borderline)
Group 3 Terrain features	
20	Occurrence of covered routes to the border
21	Presence of rivers, mountain ranges and other landmarks crossing the border, rivers flowing into the sea that can be used by violators
22	Accessibility of the railway along or across the border that is open to train traffic
23	Accessibility of the motorways along or across the border that are open to traffic
24	Presence of ancient monuments or recreation areas open to the public near the border or on the sea coast
25	Presence of settlements near the border on the domestic or neighboring territories
Group 4 The nature of economic and production activities near the border on the domestic and neighboring territories	
26	Availability of work sites on the domestic or neighboring territories, fishing areas: a) a large number; b) a single number
27	Joint work of citizens of Ukraine and a neighboring country at the facilities

Table 3 – A set of operational environment data relevant for decision-making on state border protection

No.	Indicators and elements of the operational environment
1	An assessment of specific elements of the operational environmentfor their significance (c_i)
2	A number of elements of the operational environment in a particular area of border protection (n)
3	The length of the protected section of the state border in the i-th direction (li)
4	A probability of detecting and detaining border violators on the$i$-th direction (Pi)
…	…
47	The maximum speed of border violators' advancement in the area between the border protection line and the border of the main engineering structures (V_{intr}, km/h)

Table 4 – Scale of data significance in threat assessment and risk analysis

No.	Data	Weight α_i of factor data
1	Data obtained by the SBGS on the basis of statistical observations, situational analysis, analysis of the results of operational and service activities, and criminal analysis	0.025
2	Results forthe research conducted in the sector of border management of the national security of Ukraine	0.019
…	…	…
49	Data on the accessibility of round-the-clock monitoring of the operational environment at the state border	0.025

Conclusions

The study analyzes the capabilities of the State Border Guard Service of Ukraine in the system of preventing border management threats, and develops a complex of performanceindicators and criteria to evaluatehowe efficient is the agency in this system.

From the practical point of view, the significance of the scientific results obtained suggests that the methodological apparatus developed to build a system aimed at ensuringborder management threat prevention can be used by the headquarters at all levels of the subjects within the general system of ensuring the state and national security of Ukraine in the course of performing tasks and ensuring the national interests of the state by timely detection of security vulnerabilities.

Promising areas for further research could be as follows: the development of software that will serve as a robust toolto prevent border management threats and will be used by headquarters of law enforcement agencies at all levels within the state security sector [4]; application in the decision-making support system of the state administration of security forces in the context of modern challenges for Ukraine [5]; determination of the regulations on monitoring threats to border management, developing, updating and using threat assessment and response protocols; evaluation of the capacities of units and typical elements of operational procedures; development of practical recommendations for the control centers of the law enforcement agencies of Ukraine; submission of proposals to the information acquisition structure of the SOTA Information and Analytical System used by the National Security and Defense Council of Ukraine as for supplementing its functionality.

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МЕТОДИЧНИЙ АПАРАТ СВОЄЧАСНОГО ВИЯВЛЕННЯ ЗАГРОЗ, ЯКІ ПРОЯВЛЯЮТЬСЯ У ПРИКОРДОННІЙ СФЕРІ НАЦІОНАЛЬНОЇ БЕЗПЕКИ ДЕРЖАВИ

Вирішено наукове завдання щодо розроблення науково-прикладного інструментарію (уперше розроблено методику й удосконалено модель, показники та критерії) для підвищення ефективності системи запобігання загрозам у прикордонній сфері у взаємодії із суб'єктами системи захисту національних інтересів держави.

Значний спектр небезпек і ризиків, які виникають практично в усіх сферах національної безпеки, а також необхідність запобігання негативним й деструктивним проявам і їх нейтралізації зумовлюють актуальність досліджень у зазначеному напрямі.

Досліджено проблеми забезпечення своєчасного запобігання загрозам, що постають як на державному, так і на міжнародному рівні (у прикордонному аспекті національної безпеки України), вибір шляхів підвищення можливостей для реалізації функцій щодо своєчасного виявлення загроз державній безпеці, які покладаються на систему національної безпеки держави на засадах побудови системи забезпечення запобігання загрозам у прикордонній сфері.

Наукова новизна одержаних результатів полягає в удосконалюванні моделі системи запобігання загрозам у прикордонній сфері шляхом інтеграції моделі інформаційно-аналітичної підсистеми запобігання загрозам у прикордонній сфері та моделі підсистеми реалізації заходів запобігання загрозам у прикордонній сфері з одночасним урахуванням особливостей зв'язків між ними та «командного» впливу на них інформаційних потоків, які надходять від «Моделі системи формування прикордонної політики держави». Це в цілому забезпечило системний ефект для своєчасного виявлення стану загострення обстановки та переходу її у небезпечніші стани, такі, як загрози.

Розроблена система показників і критеріїв для спрямованого пошуку кращого (раціонального) варіанта прийняття рішення щодо запобігання та протидії загрозам, що виникають у прикордонній сфері. Зазначена система враховує: рівні загроз, рівень зниження достовірності інформації з часом – під час підготовки рішення щодо реалізації заходів із запобігання загрозам. Головним завданням упровадження розробленого методичного апарату вбачається підвищення ефективності запобігання загрозам у прикордонній сфері на засадах організації інформаційної взаємодії із суб'єктами системи захисту національних інтересів держави.

Ключові слова: *державна та національна безпека, прикордонна безпека, правоохоронні органи, інтегроване управління кордонами, модель, методика, загрози, ризики, інформаційно-аналітична діяльність, оцінювання, інформація.*

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