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V. Zalozh

M. Kovalchuk

D. Bambuza

METHODOLOGICAL APPROACH TO CHOOSING A RATIONAL OPTION FOR BUILDING A BORDER GUARD DETACHMENT MANAGEMENT SYSTEM TAKING INTO ACCOUNT ITS CAPACITY TO FUNCTION UNDER MARTIAL LAW

A methodical approach to choosing a rational variant of building a border guard detachment management system is proposed, taking into account its ability to function under martial law. This approach will make it possible to choose a rational variant of building a management system under martial law, to study certain properties of the management system, and also to clarify the requirements for both the management system as a whole and its individual subsystems on the basis of a generalised quality indicator or individual quality indicators of the main properties inherent in the management system even before the start of operational activities (combat operations).

Keywords: *martial law, border guard detachment, management of forces and means, management system, quality of management, capability, assessment, selection of a rational structure.*

Statement of the problem. A border detachment (Border Guard Detachment) is the main body of state border protection (SBP) in the overall structure of the State Border Guard Service of Ukraine (SBGS), which directly performs the tasks assigned to the SBGS [1]. With the introduction of amendments to the legislative acts of Ukraine on the protection of the State Border of Ukraine [2], in addition to the functions defined in the Law of Ukraine "On the State Border Guard Service of Ukraine" [3], under martial law, the PRCS is entrusted with a defensive function related to the performance of tasks as part of the defence forces.

In order to achieve the defined goals by the PSC, it is necessary to manage the forces and means of the detachment as objects of management and the main activities (processes). Thus, the issue of choosing a rational option for building a control system (CS) of the PFCS, which will provide a process of targeted influence to aintain the readiness of the forces and means of the detachment to perform assigned tasks, their training and successful completion of tasks during operational activities, operations under martial law, remains relevant.

Analysis of recent research and publications. The issue of a comprehensive study of the functioning of military command and control systems has been considered in many studies and scientific publications. The monograph [4] analyses the military command and control system in terms of decision-making by military command and control bodies and concludes that it is advisable to analyse such systems from the perspective of the theory of organisational systems management.

Some areas of research on the functioning of the military command's ICS in a state of emergency are reflected in the scientific works of V. Batsamut, S. Belyi, O. Shmakov, O. Oleshchenko, S. Horelyshev, E. Bashkatov, and others. In particular, work [5] substantiates the structure of the military command's ICS in a state of emergency.

The issues related to the development of scientific and methodological support for assessing the SCS of the SBGS bodies were studied in their works by O. Hluzdan, V. Hluzdan [6]. They proposed a scientific and methodological apparatus for substantiating the process of forming the organisational management structure (OMS) of the BGSU bodies, and considered methodological approaches to assessing the level of their development. The general approaches to the creation, deployment of the elements of the BCS OMS and its evaluation are reflected in the regulatory documents of the border agency [8].

However, it should be noted that the issues of choosing a rational variant of the construction of the SCPE during the performance of tasks under martial law have not received sufficient attention in scientific publications. This is what determines the relevance of the declared topic of the article.

The purpose of the article is to propose a methodological approach which allows exploring alternative options for organizing the CPS and selecting the best option for its construction under martial law, taking into account the ability to function in these conditions.

Summary of the main material. The SCMS is understood as a set of functionally interconnected control bodies (CB), control points (CP) and control means [4, 8]. Each of these elements has a specific purpose and performs relevant functions, and in the presence of certain relationships between them, a new property of the system is created - ensuring the activities of the MA.

The methodological approach to choosing a rational variant of the PSCS organisation includes five stages of the study (see Figure 1 for a schematic diagram).

The first stage is to set the research task. Based on the results of the analysis, it can be argued that the current CPS of the CCDS generally allows to implement the functions of ensuring the security of the AC in peacetime. However, it belongs to the traditional hierarchical management structures [7], and therefore is not flexible enough and does not allow for a prompt response to changes in the external environment, in particular to military threats.

Thus, the requirements of certain specific laws of governance are violated, and there are inconsistencies and partial contradictions of a methodological nature in the CJSU, which in combination cause contradictions between the current state of the process of exercising the CJSU's functions under martial law and the required level of quality of their implementation.

The presence of this contradiction prompts an assessment of the capacity of the CJSU to function under martial law for the purpose of its further improvement. The capability of the ACS is defined as the ability of the system to achieve the required result when performing tasks under martial law using available resources (capabilities) [9].

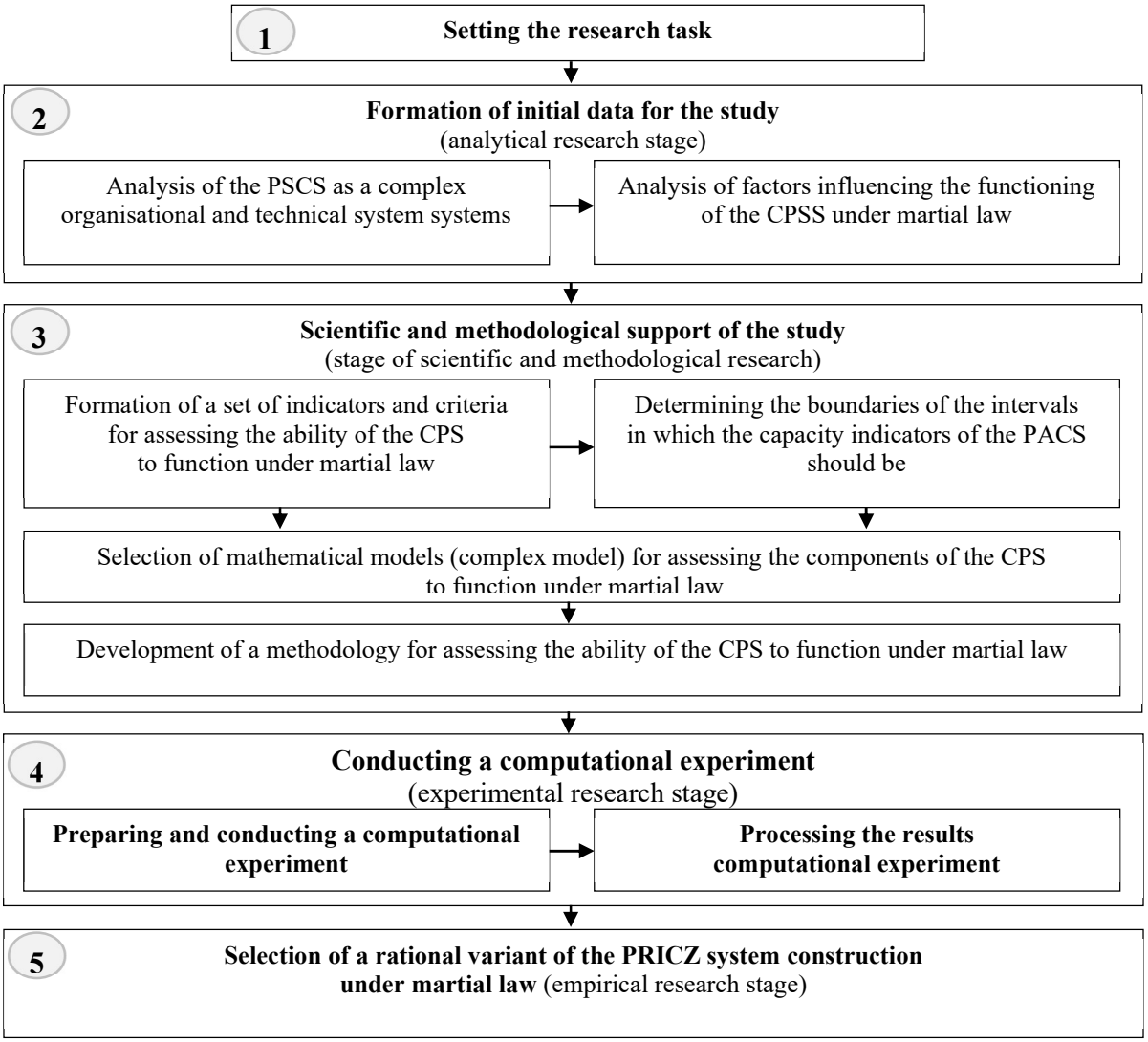

Figure 1 – Block diagram of the methodological approach to determining the rational variant of building the SCADA system under martial law

The object of the study is the process of functioning of the ACS, the subject is the quality of functioning of the ACS under martial law. The obtained result will make it possible to improve the quality of the ACS to a certain level. The process of building a rational structure of the ACS for performing tasks in a complex (multidimensional) martial law operational environment should be implemented in the following order (Figure 2).

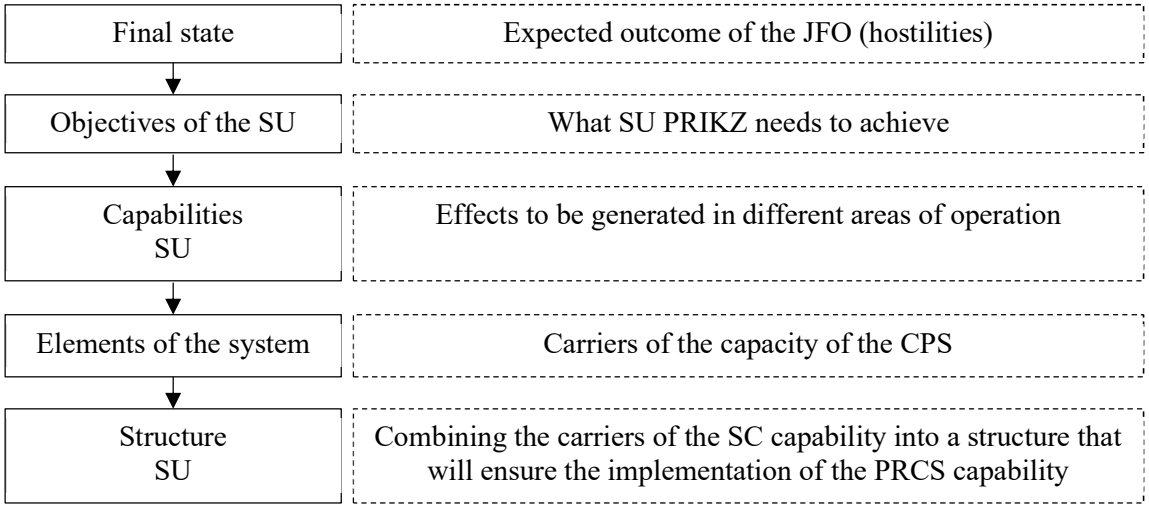

Figure 2 – Procedure for building a rational structure of the CMCS for functioning in a complex martial law operational environment

The second stage is the formation of initial data for the study. It involves analysing the CPS as a complex organisational and technical system and the factors that affect its functioning under martial law. This requires the use of system analysis, the purpose of which is to study the CMCS in detail in order to make a decision on further improvement of the system and select the best option for its construction under martial law. The tasks of the system analysis are as follows: determination of the management goal; primary decomposition of the ACS with the allocation of the management subsystem (management subjects), managed subsystem (management objects), control units, control means; determination of tasks assigned to the ACS; study of the ACS compliance with the requirements; determination of its functional features; study of the information characteristics of the system; determination of indicators and methodological approach to assessing its ability to function under martial law; generalisation of the results.

The ability of the CMCS to function under martial law is significantly affected by a set of factors (external and internal) that can be either useful – to contribute to the successful conduct of JFO (combat operations), or harmful – to counteract success. These factors affect the elements of the command and control system (MA, PU, communication system, ACS) and the overall process of command and control, and therefore require systematisation and detailed analysis.

Each factor has its own definition area. In the area of determination of the factors, it is necessary to find their maximum and minimum values, which are used further during the computational experiment and obtain the dependencies of the factors' influence on the capacity of the PACS.

The third stage is the scientific and methodological support of the study. Defining indicators and criteria for evaluating any system is always a difficult task. In the course of the study on assessing the capacity of the PACS, we believe that the quality of the system and the efficiency of the processes implemented by the system should be assessed, for which it is advisable to introduce the concept of "indicators and criteria of system quality and efficiency", which will indicate the reaction of the system under study to the impact of various factors.

The purpose of the study requires a universal methodological approach to assessing the existing capabilities of the CPSS, which will allow to evaluate each element of the capability. We believe that the DOTMLPFI methodological approach is appropriate, since it will not require significant costs for the work of experts, will contribute to an objective assessment of existing capabilities, and the conclusions obtained can be used to justify a programme for further development of the CPSCU capabilities to build its rational structure for functioning under martial law [9].

The authors use the following basic components as the basis for assessing existing capabilities using the DOTMLPFI methodological approach.

D – doctrine (doctrinal (regulatory) framework). It is characterised by the existence of concepts, guidelines, principles of application, standard operating procedures and other regulatory documents.

O – organisation (organisation of the CMCS). It is characterised by the elements that ensure the organisational sustainability of the IPPCS and create the appropriate capacity. The selection of indicators for assessing this component is carried out taking into account the factors that affect the quality (efficiency) of the IPPCS functioning and the requirements.

T – training. The existence of a training system (individual and collective preparedness of the EI staff) that creates capacity.

M – materiel (resource provision). Provision of the necessary weapons, military equipment, command and control equipment, equipment, stocks of material and technical means and consumables, as well as financial and other resources.

L – leadership (quality of management and education). Adequate level of education and training of the management staff of the EI at all levels.

P – personnel. Availability of qualified and motivated MA staff.

F – facilities. The availability and readiness of the FM (facilities and separate structures) intended to ensure that the MA performs its management tasks, as well as to accommodate and ensure their vital functions.

I – interoperability. The doctrinal (normative), operational, software and technical compatibility of the IACS for joint actions as part of the defence forces.

The capacity assessment using the DOTMLPFI approach should be based on partial mathematical models for assessing each of these components.

The condition of minimising material costs for its construction and maintaining the required level of combat readiness should be used as a cost indicator of the functioning of the SCPE.

Assessing the capacity of the PCS and its components involves the use of scaling methods, and each of the generalised indicators (components of capacity) can be represented as a set of partial indicators, taking into account the importance coefficients, the values of which can be obtained by expert assessment.

The level of capacity of the PQMS is assessed using different types of scales: nominal, interval, absolute, etc. As an option, it is proposed to use the Harrington verbal scale.

The fourth stage of research – conducting a computational experiment. It should be carried out to determine the dependencies of the influence of the main factors on the selected indicators of the PQMS capability. The results of the computational experiment can be processed using the Microsoft Office Excel spreadsheet processor.

The fifth stage of research – selection of a rational variant of the ACS construction under martial law. It is advisable to determine the options for building the ACS and develop proposals for choosing the most rational option using the methods of vector optimization theory.

Decision-making in multi-criteria nonlinear optimisation is to determine the admissible set of alternatives (options) that meet the requirements for the PQMS. In the admissible set of alternatives (options), there is a subset of "Pareto-efficient" (compromise) system alternatives that cannot be improved simultaneously for all indicators without worsening the value of at least one of them [10].

To determine the options for building a PQMS, one should use the conditions for solving the inverse problem of multi-criteria nonlinear optimisation, based on the following assumptions: the degree of achievement of the overall goal increases if the degree of achievement of all partial goals increases (each goal is represented by a corresponding quality/efficiency criterion); the degree of achievement of the overall goal increases if the degree of achievement of individual goals increases, while the degree of achievement of others does not decrease.

The choice of a rational variant of building the PCMS should be made using the obtained regression equations and the area of determining the factors, the results of which can be presented in the following form: a set of "Pareto-efficient" solutions (variants of building the PCMS), from which to choose any, since these solutions are obtained on the basis of a compromise; the most rational solution (variant) for building the PCMS according to the conditional criterion of superiority.

Conclusions

Thus, the choice of a rational variant of the ACS construction, taking into account its ability to function under martial law, is a complex and multifaceted problem, the relevance of which is confirmed by the current conditions of conducting JFO (combat operations). The proposed methodological approach makes it possible,

even before the beginning of the JFO (combat operations), to select a rational variant of the ACS construction, taking into account its ability to function in martial law, to study individual properties of the system (efficiency, stability, survivability, etc.), as well as to specify the requirements for both the ACS as a whole and its individual subsystems on the basis of a generalized quality indicator or individual quality indicators of the main properties inherent in the ACS.

Prospects for further research include the development of scientific and methodological support for assessing the ability of the CPS to function under martial law, its verification and comparative analysis.

References

1. *Nakaz Ministerstva vnutrishnikh sprav Ukrainy "Pro zatverdzhennia polozhennia pro orhan okhorony derzhavnoho kordonu Derzhavnoi prykordonnoi sluzhby Ukrainy"* [Order of the Ministry of Internal Affairs of Ukraine On the approval of the regulation on the state border protection body of the State Border Service of Ukraine activity no. 971]. (2018, 30 November). Retrieved from: http://surl.li/unygt (accessed 21 December 2023) [in Ukrainian].

2. *Zakon Ukrainy "Pro vnesennia zmin do deiakykh zakonodavchykh aktiv Ukrainy shchodo zakhystu derzhavnoho kordonu Ukrainy"* [Law of Ukraine on making changes to some legislative acts of Ukraine regarding the protection of the state border of Ukraine activity no. 2952-IX]. (2023, 24 February). Retrieved from: http://surl.li/unygy (accessed 21 December 2023) [in Ukrainian].

3. *Zakon Ukrainy "Pro Derzhavnu prykordonnu sluzhbu Ukrainy"* [Law of Ukraine about the State Border Guard Service of Ukraine activity no. 661-IV]. (2003, 3 April). *Vidomosti Verkhovnoi Rady Ukrainy*. Retrieved from: http://surl.li/unyhe (accessed 21 December 2023) [in Ukrainian].

4. Smirnov Ye. B., Tkachenko V. I., Drobaha G. A., Bilchuk V. M., Lanetsky B. M. (2008). *Teoriia pryiniattia rishen orhanamy viiskovoho upravlinnia* [Theory of decision-making by military administration bodies]. Kharkiv : KhUPS [in Ukrainian].

5. Oleshchenko O. A., Horielyshev S. A., Bashkatov Ye. H. (2019). *Metodyka obgruntuvannia ta model funktsionalnoi struktury systemy upravlinnia viiskovoho komanduvannia dlia umov nadzvychainoho stanu* [Methodology of substantiation and model of the functional structure of the military command control system for emergency conditions]. *Chest i zakon,* no. 3 (70), pp. 5–13. DOI: https://doi.org/10.33405/2078-7480/2019/3/70/189880 [in Ukrainian].

6. Zalozh V., Hluzdan O., Hluzdan V. (2019). *Naukovo-metodychnyi aparat otsiniuvannia efektyvnosti systemy upravlinnia orhanu derzhavnoi prykordonnoi sluzhby Ukrainy* [Scientific and methodological apparatus for evaluating the effectiveness of the management system of the State Border Service of Ukraine]. *Zbirnyk naukovykh prats Natsionalnoi akademii Derzhavnoi prykordonnoi sluzhby Ukrainy. Seriia : viiskovi ta tekhnichni nauky.* Khmelnytskyi : NA DPSU, vol. 2, no. 80, pp. 84–103. DOI: https://doi.org/10.32453/3.v80i2.192 [in Ukrainian].

7. Maltsev A. Yu., Hluzdan O. P., Zalozh V. V. (2021). *Metodychni pidkhody shchodo pobudovy lanok orhanizatsiinoi struktury upravlinnia Derzhavnoi prykordonnoi sluzhby Ukrainy* [Methodical approaches to the construction of links in the organizational structure of the State Border Service of Ukraine]. *Zbirnyk naukovykh prats Natsionalnoi akademii Derzhavnoi prykordonnoi sluzhby Ukrainy. Seriia : viiskovi ta tekhnichni nauky.* Khmelnytskyi : NA DPSU, vol. 2, 3, no. 85, pp. 58–79. DOI: https://doi.org/10.32453/3.v85i2-3.837 [in Ukrainian].

8. *Statut Derzhavnoi prykordonnoi sluzhby z okhorony derzhavnoho kordonu Ukrainy*. *Chastyna I. Prykordonnyi zahin (proekt).* (2004). [Statute of the State Border Service for the Protection of the State Border of Ukraine. Part I. Border detachment (project)]. Khmelnytskyi : NA DPSU [in Ukrainian].

9. Petrenko A. H. (2019). *Metodychnyi pidkhid do otsiniuvannia naiavnykh spromozhnostei funktsionalnykh struktur skladovykh oborony* [Methodical approach to assessing the available capabilities of functional structures of defense components]. *Suchasni informatsiini tekhnolohii u sferi bezpeky ta oborony,* vol. 2, pp. 99–104. DOI: https://doi.org/10.33099/2311-7249/2019-35-2-99-104 [in Ukrainian].

10. Zhurakovska O. S. (2020). *Teoriia pryiniattia rishen* [Theory of decision-making]. Kyiv : *KPI imeni Ihoria Sikorskoho*. Retrieved from: http://surl.li/dmpnmj (accessed 11 January 2024) [in Ukrainian].

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В. В. Залож, М. О. Ковальчук, Д. В. Бамбуза

МЕТОДИЧНИЙ ПІДХІД ДО ВИБОРУ РАЦІОНАЛЬНОГО ВАРІАНТА ПОБУДОВИ СИСТЕМИ УПРАВЛІННЯ ПРИКОРДОННОГО ЗАГОНУ З УРАХУВАННЯМ ЇЇ СПРОМОЖНОСТІ ДО ФУНКЦІОНУВАННЯ В УМОВАХ ВОЄННОГО СТАНУ

Запропоновано методичний підхід до вибору раціонального варіанта побудови системи управління прикордонного загону з урахуванням її спроможності функціонувати в умовах воєнного стану. Досягнення загоном охорони кордону визначених цілей потребує управління його силами й засобами (як об'єктами управління) та основною діяльністю (процесами). Тому актуальним вбачається питання вибору раціонального варіанта побудови системи управління прикордонним загоном, що забезпечить процес цілеспрямованого впливу на підтримання готовності сил і засобів загону до виконання завдань за призначенням, підготовку та успішне виконання поставлених завдань під час оперативної діяльності, операції (бойові дії). З огляду на те, що управління прикордонним загоном становить складну організаційно-технічну систему, вибір раціонального варіанта її побудови під час виконання завдань в умовах воєнного стану вимагає застосування системно-цільового методичного підходу з урахуванням здатності системи управління функціонувати в цих умовах. Сутність запропонованого підходу полягає в такому: урахування чинників, які обґрунтовують вимоги до системи управління; побудова математичної моделі функціонування системи управління; визначення спроможності системи управління; проведення векторної оптимізації (прийняття рішень за багатьма критеріями) для вибору найбільш раціонального варіанта побудови системи управління прикордонним загоном.

Методичний підхід до визначення раціонального варіанта побудови системи управління прикордонним загоном умовно передбачає п'ять етапів дослідження: постановка завдання дослідження; формування вихідних даних; науково-методичне забезпечення дослідження; проведення обчислювального експерименту; визначення раціонального варіанта побудови системи управління прикордонним загоном в умовах воєнного стану.

Запропонований методичний підхід дасть змогу до початку оперативно-розшукової діяльності (бойових дій) вибрати раціональний варіант побудови системи управління загоном охорони кордону з урахуванням його здатності функціонувати в умовах воєнного стану, досліджувати окремі властивості системи управління, а також уточнювати вимоги як до системи менеджменту в цілому, так і до окремих її підсистем на основі узагальненого показника якості чи окремих показників якості основних властивостей, притаманних системі менеджменту.

Ключові слова: *воєнний стан, прикордонний загін, управління силами й засобами, система управління, якість управління, спроможність, оцінювання, вибір раціональної структури.*

Zalozh Viktor – Candidate of Military Sciences, Associate Professor, Associate Professor of the Department of National Security and Management of the Bohdan Khmelnytskyi National Academy of the State Border Guard Service of Ukraine
https://orcid.org/0000-0001-8974-8661

Kovalchuk Maksym – Head of the Department of Educational Process Support of the Bohdan Khmelnytskyi National Academy of the State Border Guard Service of Ukraine
https://orcid.org/0009-0004-9692-8619

Bambuza Denys – First Deputy Commandant of the 3rd Border Guard Commandant's Office of Rapid Response – Chief of Staff of the 15th Mobile Border Guard Detachment
https://orcid.org/0000-0002-2975-5496