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# APPROACH TO DETERMINING CAPABILITIES OF UNITED TERRITORIAL COMMUNITIES IN THE SPHERE OF CIVIL PROTECTION

*The paper proposes an approach to determining the capacity of united territorial communities in the field of civil protection. An analysis of measures for the implementation of state policy in the field of civil protection was carried out, the basic criteria of the capacity of the territorial community were analyzed. It has been established that the problem of determining the capacity of the community in the field of civil defense is complex and poorly structured, so it is proposed to use a systematic approach to solve it. It has been proven that the indicator of the community's capacity should be determined according to the method with the dependence of the predicted number of people saved and the predicted implemented actions to eliminate the consequences of emergency situations. The proposed methodology can be used by territorial communities to assess the capabilities of the community in the field of civil protection and to take measures to improve the situation in the regions to ensure civil protection measures.*

***Key words:*** *capacity, united territorial community, emergency situation, civil protection.*

***Formulation of the problem.*** Ensuring the implementation of state policy in the field of civil protection at the regional level is carried out by the territorial subsystem of the Unified State System of Civil Protection Service (USSCPS), which includes units of United Territorial Communities (UTCs) [1]. Common to all territorial communities is the presence of citizens, business entities and public society institutions, whose activities play an important role in the community's capacity in the field of civil protection.

The Ministry of Development of Communities and Territories of Ukraine recommends focusing on the following basic criteria to determine community capacity [2, 3]:

- geographical integrity: the territory of the community cannot be divided, nor can other bodies of local self-government be located inside it;
- availability of a school of grades I-III for at least 250 students;
- 250 school children and 100 preschool children;
- additional or evaluative criteria that are proposed to be taken into account are: the number of permanent residents of the community, its area, the fiscal capacity index of the community budget, the share of local taxes and fees in it.

And also availability:

- the distance to the administrative center should be no more than 25 km,
- civil defense units (CDU) and an ambulance could take up to 20 minutes.

The mentioned factors do not take into account the issue of the capacity of the UTC in the field of civil protection, which has a negative impact on the formation of the community's resilience to various types of emergency situations (ES).

***Analysis of recent research and publications.*** The analysis of recent researches and publications shows that many scientists in their writings turn to the problems of ensuring civil protection of various territorial communities. The theoretical foundations and practical aspects of improving the

state policy for the development of territorial communities are highlighted in the works of V. D. Bakumenko, T. M. Baranovska, V. M. Vakulenko, K. O. Vashchenko, I. O. Drobot, Y. F. Zhovnirchik, O. Yu. Lebedynska, A. A. Ibrahimova, B. N. Nikolaishyna, V. O. Seryogin, V. A. Undyra.

Many domestic and foreign scientists, including O. V. Nesterenko, G. V. Ivanets, I. I. Popov, and E. I. Stetsyuk, conducted research related to the capabilities of the civil defense forces. In particular, O. V. Nesterenko proposed an approach to expert assessment of the capabilities of civil defense forces in multi-criteria tasks [4]. His approach combines the application of ontologies, expert voting procedures and corresponding calculation procedures. G. V. Ivanets, I. I. Popov, and E. I. Stetsyuk, using the examples of civil defense units, investigated the potential technical capabilities of the units through indicators of the technical and operational level of weapons and equipment [5].

At the same time, the problem with the definition of the capacity of the community in the field of civil protection has remained out of the attention of scientists, which makes it difficult to perceive the measures that must be carried out in the UTC for the proper level of preparedness in the field of civil protection.

***Formulation of the goals of the article.*** In order to solve the problem, it is first necessary to establish the criteria affecting the capacity of the community in the field of civil protection, and then to determine the algorithm for their processing, taking into account the interrelationships. As a result, we will be able to conduct a quantitative assessment of the ability of the community in the field of civil protection, as well as of business entities and citizens to prevent and respond to emergency situations of various nature. In fact, it will be necessary to solve a multi-criteria problem using the appropriate mathematical apparatus.

***Presentation of the main research material.*** The basis of models of the capabilities of military formations, units of operational rescue service and other forces and means of civil defense are the tactical capabilities of one unit [6, 7]. According to the tactical capabilities of the unit, it is possible to determine the capacity of the unit, detachment, etc. The use of these models in the tasks of determining the capacity of the community in the field of civil protection is complicated, since this task in the field of civil defense is multi-component and multi-factorial. These components and factors may be unrelated, for example: what is more important to have protective structures or transport for evacuating the population; which type of protective structure is better (engineering structure, storage or anti-radiation shelter); having some and other means, but not having effective notification does not give a positive result, etc.
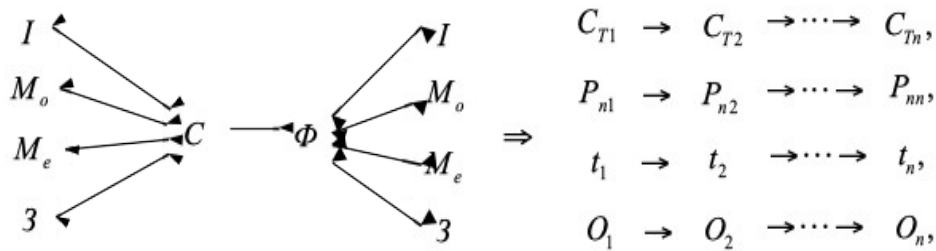
Solving the task set in the research, we will first define the basic concept of community capacity in the field of civil protection. According to [7, 8], community capacity must be targeted at the people living in the community, the territory, and the surrounding natural environment. Then, the community's ability to perform tasks aimed at protecting the population, territories, natural environment and property from natural disasters by preventing such situations, eliminating their consequences and providing assistance to victims in peacetime and in special periods will be the ability of the community.

According to [8-10] and the recommendations of the State Emergency Service of Ukraine [11], the UTC is entrusted with a number of tasks in the field of civil protection:
- training of the population on actions in the National Emergency;
- creation of a commission on technogenic and ecological safety and emergencies;
- alerting and informing the population about the threat and occurrence of an emergency;
- sheltering the population in the protective structures of the Central Military District;
- evacuation of the population to safe areas, their placement;
- radiation, chemical, biological, medical protection of the population;
- organization of emergency response works and elimination of their consequences;
- ensuring the livelihood of victims of natural disasters;
- management of the established local (voluntary) fire brigade, control over readiness for action as assigned.

Based on the tasks set, it can be said that the problem of determining the capacity of the community in the field of civil defense is complex and poorly structured. Therefore, to solve it, you can use the system approach [12], as a methodology for solving complex problems (Fig. 1). The

components of the system approach are systematization, formalization and their research from the standpoint of considering the life cycle of the object (in this case, the community). Obviously, community capacity can change over time. It can decrease due to equipment failure and increase when additional emergency and rescue equipment is installed, additional fire departments are created, etc.

$$C_{T1} \rightarrow C_{T2} \rightarrow \cdots \rightarrow C_{Tn},$$
$$P_{n1} \rightarrow P_{n2} \rightarrow \cdots \rightarrow P_{nn},$$
$$t_1 \rightarrow t_2 \rightarrow \cdots \rightarrow t_n,$$
$$O_1 \rightarrow O_2 \rightarrow \cdots \rightarrow O_n,$$

*I - information, M0 - models, Me - methods, C - means, C - systematization, Ф - formalization, C1 - forces and means of the central organization, Pn1 - management organization,   t - time, Si - level of capability, and=1,n*

Figure 1 - Structural diagram of the system approach

If the total number of criteria is minimized, the capacity of the community can be described as dependence

$$S = f(N, D) \tag{1}$$

where $S$ - is an indicator of community capacity; $N$ – predicted number of rescued;
$D$ - predicted implemented actions to eliminate the consequences of the emergency.

Dependency (1) is a function of two components: the possible number of rescued people and the possible predicted actions of the units of the Center for the elimination of the consequences of the emergency. The result of the solution of dependence will be a number from 0 to 1, according to which a conclusion can be drawn about the capacity of the community in the field of civil protection. The first steps of determining the specified components are presented in fig. 2.
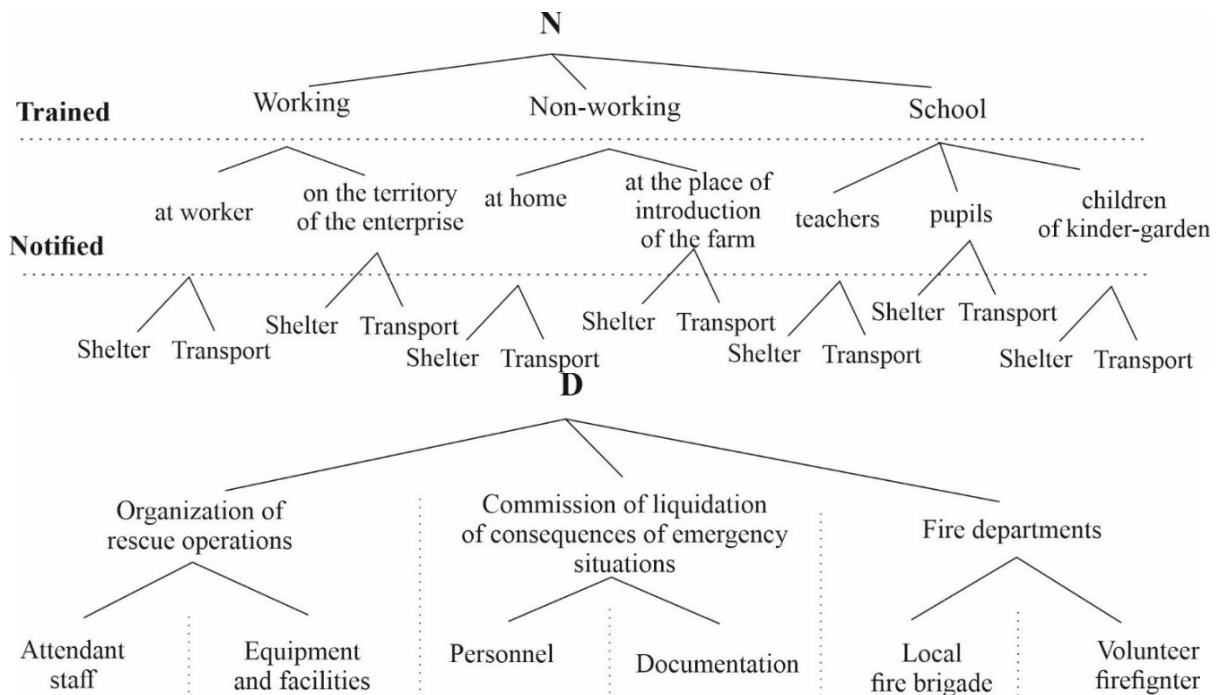
Figure 2 – Schematic representation of the calculation of the possible number of people saved from dangerous emergency factors: a) predicted number of people saved from dangerous emergency factors; b) predicted actions of the Central Committee units

After systematizing the received information, we will get addiction as a result

$$N_{н.о.} = \frac{N_{н} \cdot N_{з.о.} \cdot U_c}{N_з},$$ (2)

where $N_{н.о.}$ - the number of trained and notified persons, $N_{н}$- the number of trained people, $N_з$- the total number of people in need of protection, $N_{з.о.}$ - the number of persons in the area of the notification means, $U_c$ - the probability of triggering the warning system.

Since the total capacity of shelters and means of evacuation $N_{у.е.}$ may be insufficient, the following dependence should be applied:

$$N = \begin{cases} If\ N_{н.о.} < N_{у.е.}, then\ N_{н.о.} \\ ¿\ If\ N_{н.о.} \geq N_{у.е.}, then\ N_{у.е.} \end{cases}$$ (3)

The forecasted implemented actions to eliminate the consequences of emergency situations should be considered as a normalized indicator of the ability to eliminate emergency situations depending on their scale and type (Fig. 3).

$$D = D_m * D_n * D_c * D_в$$ (4)

where $D_m$ – the normalized indicator of the ability to eliminate man-made natural disasters, $D_n$- the normalized indicator of the ability to eliminate natural natural disasters, $D_c$- the normalized indicator of the ability to eliminate social natural disasters, $D_в$- the normalized indicator of the ability to eliminate military natural disasters.
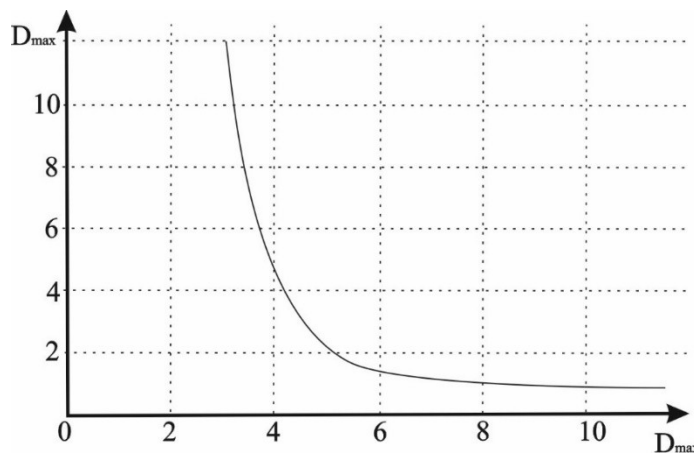


Figure 3 – Standardized indicator of the ability to eliminate emergencies by civil defense units

We will use the dependence to calculate the capacity of the community in the field of civil protection:

$$S = \frac{N}{N_з} D$$ (5)

The conclusion of the resolution of dependence (5) can be three variants of the capacity of the community in the field of civil protection (Table 1): low capacity, medium capacity and high capacity.

Table 1 - Estimated division of community capacity in the field of civil protection

| Low capacity | Average capacity | High capacity |
|---|---|---|
| $S \leq 0.3$ | $0.3 < S \leq 0.7$ | $S > 0.7$ |

If the performed calculation results in a variant of low and medium capacity, then it is necessary to take measures to attract additional forces and means to ensure the proper state of civil defense of the community. These can be fire and rescue units of the operational and rescue service of civil protection, voluntary formations, local fire brigades and other units of the civil protection service that border the territory of the relevant territorial community. In addition to fire and rescue units, it is possible to envisage additional involvement of forces and means of public organizations and business entities. Appropriate involvement must be confirmed by the interaction instructions, which are approved in the prescribed manner.

***Conclusions.*** Summing up, we can say that there is no method of determining the capacity of the UTC in scientific literary sources. Community capacity depends on many internal and external factors. The safety of the community and the environment depends on the activity and efficiency of their activities.

The proposed methodology can be used to assess the capabilities of the community in the field of civil protection. The obtained results make it possible to identify problematic issues in the field of civil protection and to establish more clearly which civil protection measures must be taken in a specific united territorial community.

***Prospects for further research.*** Further research should be directed to the development of criteria for assessing the role of civil society institutions in the methodology of determining the capacity of communities in the field of civil protection. With such a methodology, citizens, business entities and civil defense regulatory bodies will be able to clearly establish what the community needs to do today so that every resident feels completely safe.

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## ПІДХІД ДО ВИЗНАЧЕННЯ СПРОМОЖНОСТЕЙ ОБ'ЄДНАНИХ ТЕРИТОРІАЛЬНИХ ГРОМАД У СФЕРІ ЦИВІЛЬНОГО ЗАХИСТУ

*Наукова стаття присвячена питанню захисту об'єднаних територіальних громад від надзвичайних ситуацій різного характеру. У роботі запропонований підхід до визначення*

*спроможності об'єднаних територіальних громад у сфері цивільного захисту. Проведений аналіз заходів реалізації державної політики у сфері цивільного захисту, проаналізовані базові критерії спроможності територіальної громади. Встановлено, що проблема визначення спроможності громади у сфері цивільного захисту, є складною і слабко структурованою, тому для її вирішення запропоновано використати системний підхід. Доведено, що показник спроможності громади повинен визначатися за методикою із залежністю прогнозованої кількістю врятованих та прогнозованими реалізованими діями з ліквідації наслідків надзвичайних ситуацій. Запропонована методика може бути використана територіальними громадами для оцінити спроможності громади у сфері цивільного захисту та для прийняття заходів щодо поліпшення ситуації в регіонах із забезпечення заходів цивільного захисту.*

*Ключові слова: спроможність, об'єднана територіальна громада, надзвичайна ситуація, цивільний захист*