



Research article

Assessment of military preparedness for naturogenic threat: the COVID-19 pandemic in the Czech Republic

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ABSTRACT

This article deals with the provision of cooperation of the Army of the Czech Republic with other units of rescue teams in the implementation of rescue and liquidation work in the regions of the Czech Republic in non-military crisis situations. At the present time of the global pandemic of covid-19 and the associated mass deployment of forces and resources of the primary and secondary units of the rescue system, the required effective cooperation in practice has proved necessary. The paper deals with the analysis of emergency management in a state of emergency in order to contribute to the improvement of civil-military cooperation. Based on the results of the research survey, the authors proposed evaluation criteria for determining the level of emergency preparedness of the forces and resources of the Army of the Czech Republic.

1. Introduction

The article focuses on the issue of civil-military cooperation, active reserves and the current capabilities of the Army of the Czech Republic in providing cooperation with other units of the rescue teams of the integrated rescue system (IRS) in the implementation of rescue and liquidation work in the Czech Republic.

In the Czech Republic (CR), the IRS is not an institution, office, or association; it is a system of work with tools and model procedures of cooperation (Act on The Integrated Rescue System, No. 239/2000 Coll). It is part of the system for ensuring the internal security of the state. It is a system of contractual arrangements, and a coordinated procedure of its units in the preparation for emergency events (EE) and in the implementation of rescue and liquidation work. The primary units of the IRS are the Fire Rescue Service, the Police of the Czech Republic and the Medical Rescue Service. Secondary units are allocated forces and resources of the armed forces (Army of the Czech Republic), other security forces (Municipal Police), non-governmental non-profit organizations (e.g. Czech Red Cross, People in Need, etc.), public health authorities and other services (e.g. hygiene or veterinary authority). The primary units of the IRS ensure continuous emergency service for receiving reports of the occurrence of an emergency event and urgent intervention. The secondary units provide contractual assistance on the basis of a pre-concluded agreement on planned assistance on request (Talhofer and

Hošková-Mayerová, 2019; Navrátil et al., 2019). The forces and resources of secondary units are included in the IRS alarm plan of individual regions of the Czech Republic (the Czech Republic has 14 regions). This increases the capacity of forces and resources of the primary units of the IRS. The IRS system is activated always when it is necessary to perform rescue with at least two primary units at the same time.

The Army of the Czech Republic (ACR) primarily performs tasks related to ensuring external security in the event of a military crisis. The ACR is established for this activity, and preparation for this type of threat is its main task in peacetime. The ACR forces and resources (F&R) are involved in the management of crisis situations of a non-military nature in the regions of the Czech Republic (CR) as a secondary unit of the IRS, based on a regulation of the Government of the CR. The ACR detachments included in the Central Alarm Plan of the Czech Republic (CAP) (Ministry of Interior, 2020) are selected for the fulfillment of these tasks. This is done on the basis of an agreement on assistance on request (Act 239/2000 Coll., On IRS). The issue is that the detachments and the ACR, as a whole, are being prepared to perform tasks for resolving a crisis situation of a military nature (Otrisal et al., 2018). They are not trained for cooperation in resolving a crisis situation of a non-military nature. In addition to rescue and liquidation work, the dedicated F&R of the ACR participate in the fulfillment of internal security tasks in cooperation with the Police of the Czech Republic (PCR), and provide the air medical rescue service and the air search and rescue service. Specialized

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detachments of the ACR are usually activated in cases when the primary units of the integrated rescue system are exhausted, or when it is necessary to use the capabilities of specialized parts of the ACR, which the civil rescue system does not have.

Experience in dealing with the consequences of natural disasters as well as experience in the current management of the consequences of the COVID-19 pandemic have shown that armed forces around the world have an irreplaceable position in dealing with non-military crises (Hoskova-Mayerova, 2016; Potůček, 2020; Svarcova et al., 2016). For this reason, in the opinion of the authors, it is essential that modern armed forces in the Czech Republic and in the world have such types of forces whose primary activity is precisely to prepare for crisis situations of a non-military nature (Kudlak et al., 2020). Fortunately, in recent history, there has never been a situation where the Czech Republic would face both military and non-military threats, but precisely for these cases it is necessary to have both the types of forces designed to defend the territory and the types of forces that will perform humanitarian civil protection tasks (Otrisal and Florus, 2014).

However, discussions about the most efficient, effective and sustainable approach to dealing with complex emergency events have a historical tradition. Examples are the debates on crisis development and resolution in Afghanistan, Iraq or Sudan (Kasselmann, 2012; Sundin et al., 2011), as well as assessments of civilian-military solutions to natural disasters, such as the earthquake in Haiti, tsunami in Indonesia or large-scale fires in Australia (Munro, 2015; Djuyandi et al., 2019). These initiatives call on all stakeholders to find new solutions to the shortcomings and potential failures identified in the field of civil-military cooperation. This is especially true with regard to the question of when, where, and how a military instrument should be integrated into the activities of civilian entities involved in resolving complex emergency events, based on an overall political rationale (Kasselmann, 2012).

From a military point of view, however, an opinion prevails aimed at determining the right tactical approach, and wider discussions are only tangentially useful. In contrast, the civilian side emphasizes that the solution of a complex emergency event should be implemented primarily through civilian resources (Essens and de Vries, 2016).

The nature of complex humanitarian missions, peace-building and its reconstruction is increasingly forcing military and civilian stakeholders to cooperate in the same space and time (Franke, 2006). Many authors of scientific articles seek to explore the cultural, organizational, operational, and normative differences between civilian and military donors of aid and security in current operations that support the stability of the territory. They also try to develop recommendations for improving civil-military cooperation (CIMIC), to help ensure more effective delivery of stabilization and transformation interventions (Nowakowska et al., 2020; Ruffa, 2018; Grigorov et al., 2017; Essens and de Vries, 2016).

A similar potential is emphasized by the presented article, which deals with the analysis of the ACR's emergency preparedness during the state of emergency in the Czech Republic, declared as a result of the COVID-19 pandemic. The aim of the paper is to determine the criteria according to which the current state could be evaluated and to determine the indicators for determining the degree of fulfillment of these criteria. By fulfilling the above-mentioned goal, the authors wanted to contribute to the improvement of civil-military cooperation in solving disasters or pandemic situations.

Based on the results of the research survey, the authors proposed evaluation criteria for determining the level of emergency preparedness of the ACR forces and resources, and recommendations for improving the effectiveness of collaboration in civil-military cooperation in the Czech Republic.

The paper is organised as follows:

Section 2 describes the ways and procedures of requiring the F&R of the ACR for civil-military cooperation. Section 3 describes the principles of setting criteria and their indicators, and the chosen questionnaire method. Section 4 presents the results of the research survey and the obtained values of weights for individual criteria and their indicators.

This chapter also proposes certain recommendations for improving the current situation in the field of civil-military cooperation during a pandemic.

2. Currently applied process of F&R deployment in the Czech Republic

For the solution of crisis situations and emergency events, there are standardized operational procedures in the ACR, which solve the process of deploying the F&R of the ACR.

2.1. Situations with the use of F&R in emergency events (low level threat)

In the event of a large-scale crisis situation, the authorized IRS units may, through the Operations and Information Center (OIC), require the cooperation of the allocated F&R of the ACR. Figure 1 shows the process of deployment of the F&R of the ACR listed in the Central Alarm Plan (Ministry of Interior, 2020) from the acceptance of the application from the OIC to the termination of activities of the deployed F&R of the ACR.

2.2. Situations that require F&R deployment in a crisis situation (higher level threat)

In the event of a large-scale crisis situation of a non-military nature, the government of the Czech Republic decides on the declaration of a state of emergency. If a state of emergency is declared, it can be assumed that the government of the Czech Republic will issue an order to call the F&R of the ACR for rescue and liquidation work to manage the consequences of a crisis situation. Figure 2 describes the individual phases of deployment of F&R of the ACR in this situation.

3. Materials and methods

The Ethical Commission, University of Defence in Brno has confirmed compliance with ethical standards. All procedures, including data collection and processing, performed in the study were in accordance with the 1964 Helsinki Declaration and its subsequent amendments or comparable ethical standards. Informed consent was included in the online questionnaire form, and all individual participants in the study continued to receive an informed consent form.

The basic principle for increasing the level of emergency preparedness of civil-military cooperation is to eliminate or minimize the identified shortcomings from already implemented interventions in crisis situations, from verification exercises, and also from published retrospective analyses of the crisis situations in the country and abroad. From the point of view of civil-military cooperation in the Czech Republic,

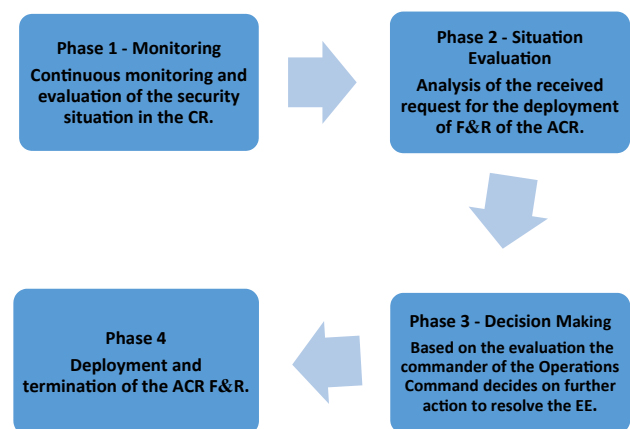


Figure 1. Process of deploying forces and resources of the ACR specified in the Central Alarm Plan (Petráš, 2020).

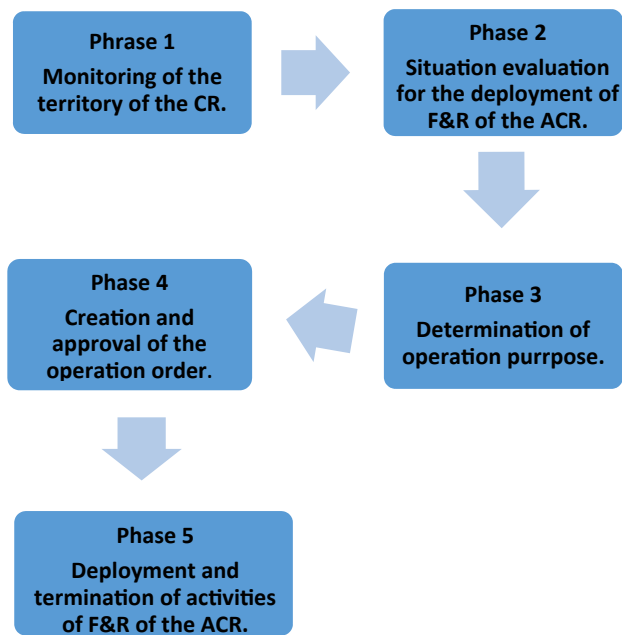


Figure 2. Individual phases of deployment of F&R of the ACR when declaring a state of emergency (Petráš, 2020).

standardization of processes and planning is needed. In the Czech Republic, there are currently no standard procedures and evaluation criteria that would allow a comprehensive assessment or comparison of the level of emergency preparedness of the ACR for dealing with non-military crisis situations (Svarcova et al., 2015).

Thus the research objective of the authors was to determine the criteria according to which the current state will be assessed, and indicators for determining the degree of fulfillment of these criteria. The methodology from paper (Tuser and Navratil, 2020) was used. To obtain relevant criteria and indicators, a brainstorming meeting was carried out with members of the ACR at the tactical, operational and strategic level of the ACR command, with a total of 33 experts. The performed brainstorming determined four basic criteria and their indicators, which were used to determine their fulfillment (Table 1).

To determine the fullness of indicators, sub-questions were created to respondents in the form of a questionnaire (see below). The Saaty's method (Saaty 1994) was used to determine the weights of individual criteria and indicators. Respondents were presented with a Saaty's matrix evaluating the relationship of individual criteria.

Table 1. Criteria and indicators.

Criterion	Indicators for the criterion fulfillment (and their marking)
Criterion A Human resources	<ul style="list-style-type: none"> Quantity of allocated forces (marked I_1^A and its fulfillment is marked k_1^A) Preparedness of allocated forces to perform tasks in favor of IRS (quality) (marked I_2^A and its fulfillment is marked k_2^A) Preparedness of control officers of allocated forces (marked I_3^A and its fulfillment is marked k_3^A)
Criterion B Technical security of allocated forces	<ul style="list-style-type: none"> Transport equipment (marked I_1^B and its fulfillment is marked k_1^B) Special equipment (marked I_2^B and its fulfillment is marked k_2^B) Material and logistical support (marked I_3^B and its fulfillment is marked k_3^B)
Criterion C Command and control of allocated forces	<ul style="list-style-type: none"> Command and control system (marked I_1^C and its fulfillment is marked k_1^C) Notification of ACR units and facilities (marked I_2^C and its fulfillment is marked k_2^C) Means of communication (marked I_3^C and its fulfillment is marked k_3^C)
Criterion D Planning the deployment of F&R of the ACR	<ul style="list-style-type: none"> Planning and management documentation (marked I_1^D and its fulfillment is marked k_1^D) Standardized operating procedures (marked I_2^D and its fulfillment is marked k_2^D)

3.1. Questionnaire

The questionnaire was carried out at:

- military units in all regions of the Czech Republic;
- organizational units of the Ministry of Defence with nationwide competence, which were directly involved in securing measures related to the declaration of a state of emergency due to the COVID-19 pandemic in March–May, 2020;
- Operations Command, which currently manages operations in the Czech Republic designed to manage the consequences of the pandemic;
- members of the Ministry of Defence participating in the activities of the Strategic Command and Control Group.

A total of 21 stakeholders took part. The limiting factor for the scope of the entire investigation was the prohibition of personal contact within the Ministry of Defence, issued as a measure to prevent the spread of the COVID-19 epidemic.

3.2. Determination of the fulfillment of indicators by questionnaire method

In response to the sub-questions, the respondents chose the variant that most closely corresponds to their opinion by assigning a value in the range of 1–5 according to the evaluation system determined by the authors. The questions used to determine the fulfillment of the indicators are listed below, together with the evaluation system for the fulfillment of the indicators. Some sub-questions require the respondent to provide a verbal statement, these questions are further highlighted in *italics* in the text. Table 2 presents the average evaluations of indicators by individual respondents.

The respondents were asked to use the following evaluation system for fullness of indicators:

- 5 completely fulfilled
- 4 fulfilled to a greater extent
- 3 moderately fulfilled
- 2 largely unfulfilled
- 1 not fulfilled at all.

The questionnaire sub-questions structure was as follows:

CRITERION A-HUMAN RESOURCES

A1 indicator sub-questions-Quantity of allocated forces

- In your opinion, is the amount of allocated forces in favor of the IRS sufficient to fulfill the tasks?
- Is the distribution of predetermined detachments adequate for the performance of tasks in the event of emergency events and crisis

Table 2. Criteria.

SUBJECT	Criterion A			Criterion B			Criterion C			Criterion D	
	I_1^A	I_2^A	I_3^A	I_1^B	I_2^B	I_3^B	I_1^C	I_2^C	I_3^C	I_1^D	I_2^D
1.	1	0.6	0.8	1	1	0.7	0.9	1	0.8	0.93	1
2.	0.8	0.75	0.5	0.6	0.4	0.8	0.6	0.9	0.6	0.93	1
3.	0.87	0.6	0.5	0.8	0.8	0.5	0.4	0.8	0.65	0.73	0.6
4.	0.93	0.55	0.8	0.9	0.9	1	1	1	0.7	1	0.8
5.	0.67	0.45	0.4	0.8	0.8	0.4	0.6	0.7	0.4	0.73	0.6
6.	0.53	0.35	0.5	0.6	0.5	0.6	0.6	0.8	0.8	0.6	0.7
7.	0.8	0.65	0.8	0.7	0.8	0.8	0.9	1	0.75	0.86	0.8
8.	1	1	1	0.7	0.6	1	1	0.9	0.75	1	1
9.	0.53	0.8	0.1	0.6	0.5	0.6	0.6	0.3	0.75	0.73	0.6
10.	0.67	0.8	0.8	0.9	0.8	0.2	0.9	1	0.6	0.86	0.2
11.	0.86	1	0.9	0.8	0.9	1	1	1	0.9	1	1
12.	0.8	0.75	0.7	0.5	0.5	0.7	0.8	0.8	0.85	0.6	0.7
13.	0.6	0.65	0.6	0.5	0.5	0.8	0.8	0.8	0.95	0.93	0.8
14.	0.47	0.45	0.8	0.4	0.4	0.6	0.7	0.9	0.75	0.6	0.6
15.	1	0.55	0.8	0.7	0.7	0.8	0.8	0.9	0.75	0.73	0.8
16.	0.67	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.65	0.73	1
17.	0.87	0.75	0.8	0.9	0.8	0.7	0.7	0.8	0.65	0.53	0.6
18.	0.8	0.53	0.45	0.7	0.6	0.6	0.8	0.7	0.6	0.86	0.4
19.	0.53	0.45	0.7	1	0.6	0.8	0.9	0.6	0.65	0.73	0.9
20.	0.46	0.55	0.2	0.9	0.9	1	1	0.9	1	0.86	0.9
21.	0.53	0.4	0.4	0.6	0.7	0.7	0.7	0.5	0.5	0.67	0.6
22.	0.75	0.65	0.45	0.6	0.6	0.7	0.85	0.85	0.9	1	0.9
23.	0.6	0.6	0.6	0.8	0.8	1	0.55	0.8	1	0.8	0.76
24.	1	0.55	0.7	0.5	0.5	0.7	0.8	0.9	0.55	0.75	0.45
25.	0.85	0.8	0.9	0.8	0.2	0.9	0.75	1	0.75	0.8	0.75
26.	0.45	0.3	0.55	1	0.9	0.6	0.65	0.6	0.8	0.85	0.8
27.	0.7	0.45	0.4	0.9	0.8	0.4	0.6	1	0.75	0.8	1
28.	0.8	0.45	0.9	0.7	0.5	0.5	0.7	0.8	0.75	0.45	0.9
29.	0.95	0.8	0.2	0.9	0.55	0.75	0.8	0.75	0.8		1
30.	0.7	0.5	0.55	0.7	0.8	1	0.75	0.55	0.9	0.45	0.8
31.	0.55	0.45	1	0.75	0.65	0.8	0.8	0.9	0.8	0.2	1
32.	0.8	0.75	0.8	0.8	0.9	0.8	0.2	0.9	1	0.55	0.75
33.	0.45	1	0.55	0.75	0.65	0.9	0.8	0.3	0.9	1	0.8

situations (hereinafter referred to as EE/CS) throughout the Czech Republic?

- Are the time standards adequate with regard to the transport capabilities of the allocated equipment?

A2 indicator sub-questions-Preparedness of allocated forces to perform tasks in favor of IRS

- Is systematic and continuous education and training implemented in connection with specific risks/potential EE/CS mentioned in crisis planning? *If so, how often?*
- Is your department/military facility participating in cooperation exercises with the involvement of primary and secondary IRS units?
- Does the authorized employee periodically re-evaluate/verify/inspect and respond to the current state of knowledge, skills and competencies of employees?
- Is there a quality evaluation system in place? (e.g. internal audit) *If yes, which one?*

A3 indicator sub-questions-Preparedness of control officers of allocated forces

- Is there a systematic and continuous education and training of officers in charge of managing the allocated forces in connection with specific risks/potential EE/CS mentioned in the crisis planning?
- In your opinion, is the training of commanding officers in the field of EE/CS sufficient?

CRITERION B-TECHNICAL SECURITY OF ALLOCATED FORCES

B1 indicator sub-questions-Transport equipment

- Are the numbers of allocated transport equipment adequate for the performance of tasks in favor of the IRS?
- Is the predetermined transport equipment maintained in proper condition (from the point of view of modernization and operability)?

B2 indicator sub-questions-Special equipment

- Are the numbers of allocated special equipment adequate for the performance of tasks in favor of the IRS?
- Is the predetermined special equipment maintained in proper condition (from the point of view of modernization and operability)?

B3 indicator sub-questions-material and logistical support

- Is your unit/military facility able to secure the allocated units during a weekly cycle?
- Is your unit/military facility able to secure the allocated units during 30 days?

CRITERION C-COMMAND AND CONTROL OF ALLOCATED FORCES

C1 indicator sub-questions-Command and control system

- Does the command and control system allow a flexible response to EE/CS?
- Are there regular inspections and exercises to check the command and control system?

C2 indicator sub-questions-Notification of ACR units and facilities

- Depending on time standards, is the unit and facility notification system effective?
- In case of danger in delay, are military facilities able to flexibly allocate the necessary forces and resources?

C3 indicator sub-questions-means of communication

- Does the ACR have a sufficient number of connecting means to secure the main and backup voice connection?
- Is there a regular modernization of connecting means and their revision? (In the case of large EE/CS, there is a possibility of network congestion.)
- Is the compatibility of the means of connection between the IRS and the ACR ensured? (telephone, mobile phone, radio connection, connection via operations and information center)
- In the case of "blackout", is the ACR able to provide an alternative connection? *If so, which one? How will the transfer of information during rescue work be solved in the event of a large-scale disruption of electricity supplies for a period of approximately three days between the IRS and the ACR?*

CRITERION D-PLANNING THE DEPLOYMENT OF THE F&R OF THE ACR

D1 indicator sub-questions-Planning and management documentation

- Are there regular inspections of the planning and management documentation at your facility?
- Are the facts stated in the planning and management documentation objectively feasible?
- Based on your experience with the allocation of the F&R of the ACR, is the planning management documentation prepared at such a level as to ensure the effective deployment of the F&R of the ACR for the benefit of the IRS?

D2 indicator sub-questions-Standardized operating procedures (SOP)

- Are SOP for allocating F&R prepared at your department/military facility?
- Is training performed at your department/military facility according to the given SOP?

The degree of fulfillment of indicators according to the opinions of individual respondents was calculated as the sum of points awarded according to the evaluation system, which was subsequently divided by the maximum possible number of points for the given indicator. The fulfill-

ment of indicators determined by means of a questionnaire survey therefore takes values in the interval [0, 1]. The average values of the fulfillment of each indicator were calculated as an arithmetical average. The results are given in Table 3.

3.3. Saaty's method

Saaty's method is designed to determine the weights of a total of n indicators. The principle of this method is that the respondent gets an empty square table with n rows and n columns, the so-called Saaty's matrix $S(s_{ij})$, index i denotes a row, index j denotes the column in which the element s_{ij} is located. The respondent assigns one of the values described in Table 4 to the elements s_{ij} (Saaty, 1980, 1994).

- The value of the element s_{ij} is the respondent's estimate of the share of the weights v_i i -th and v_j j -th indicator, i.e.

$$s_{ij} \approx \frac{v_i}{v_j} \tag{1}$$

- The elements are reciprocal according to the main diagonal, so $s_{ji} = \frac{1}{s_{ij}}$ holds for all $i, j \in 1, 2, \dots, n; n \in N$.

The Saaty's matrix was processed as follows:

- 1) First, it was verified that the matrix is sufficiently consistent, i.e. $s_{ik} \cdot s_{kj} \approx s_{ij}$ applies for all triplets $i, j, k = 1, \dots, n; n \in N$. Thus, the products of the individual elements of the Saaty's table must be approximately equal to one (Alonso and Lamata 2006). In practice, the fulfillment of this condition is verified by inequality

$$\lambda_{max} < n + 0,1(1,7699n - 4,3513),$$

where n is the size of the table. The symbol λ_{max} indicates the largest eigenvalue matrix number. The authors verified this condition using MAPLE software. Fulfilling this inequality guarantees the correct results of the Saaty's method.

- 2) Subsequently, the value of $s_i = s_{i,1} \cdot s_{i,2} \cdot s_{i,2} \cdot \dots \cdot s_{i,n}$ was calculated for each i .
- 3) Then the value of $R_i = \sqrt[n]{s_i}$ was calculated for each i . These are the geometric averages of the values $s_{i,1}, s_{i,2}, s_{i,2}, \dots, s_{i,n}$.
- 4) Finally, the sum of $R = R_1 + R_1 + \dots + R_n$ was calculated, and for each i we calculate the weights:

$$v_i = \frac{R_i}{R} \tag{2}$$

Table 3. Fulfillment of indicators.

Criterion	Indicators for the fulfillment of the criterion	Fulfillment of the indicators
A	I_1^A	$k_1^A = 0.726$
	I_2^A	$k_2^A = 0.622$
	I_3^A	$k_3^A = 0.628$
B	I_1^B	$k_1^B = 0.739$
	I_2^B	$k_2^B = 0.671$
	I_3^B	$k_3^B = 0.731$
C	I_1^C	$k_1^C = 0.750$
	I_2^C	$k_2^C = 0.801$
	I_3^C	$k_3^C = 0.756$
D	I_1^D	$k_1^D = 0.758$
	I_2^D	$k_2^D = 0.773$

Table 4. Indicator evaluation system.

s_{ij}	Description
1	indicators i, j are equally significant
3	indicator i is slightly more significant than indicator j
5	indicator i is quite more significant than indicator j
7	indicator i is demonstrably more significant than indicator j
9	indicator i is absolutely more significant than indicator j
1/3	indicator j is slightly more significant than indicator i
1/5	indicator j is quite more significant than indicator i
1/7	indicator j is demonstrably more significant than indicator i
1/9	indicator j is absolutely more significant than indicator i

4. Results

4.1. Determination of weights of indicators and criteria by Saaty's method

Examples of weights obtained from the first 10 respondents are given in Table 5. Each row of this table corresponds to one processed Saaty's matrix (Saaty's matrix-example in Appendix 1, Table A1). The last line shows the final weights, which are calculated as the average of the weights over the individual respondents (Bekesiene and Hoskova-Mayerova, 2018).

The weights in Table 5 are rounded to three decimal places with respect to the sum of the weights being equal to one. The weight of individual criteria is marked by symbols v^j , where $j \in \{A, B, C, D\}$. The values v^j are obtained as the sum of the weights over the individual indicators, i.e. in the form

$$v^j = \sum_{i=1}^3 v_i^j = v_1^j + v_2^j + v_3^j, \tag{3}$$

where $j \in \{A, B, C, D\}$. A similar procedure was used to obtain the weight of the other criteria. The resulting values are shown in the following Table 6.

4.2. Calculation of the total fulfillment of criteria

The level of preparedness in the specified area (sphere, standard) is indicated by the fulfillment of the relevant criteria. In order to evaluate the extent and depth of fulfillment of the criteria identified on the basis of the conducted research survey, the capacity to meet these criteria had to be determined.

Table 5. Table of weights.

Table of weights for individual respondents and indicators												
criteria	A			B			C			D		sum
indicators	I_1^A	I_2^A	I_3^A	I_1^B	I_2^B	I_3^B	I_1^C	I_2^C	I_3^C	I_1^D	I_2^D	
resp. 1	0.294	0.153	0.186	0.049	0.082	0.135	0.039	0.02	0.024	0.007	0.011	1
resp. 2	0.128	0.11	0.166	0.059	0.024	0.013	0.101	0.144	0.019	0.105	0.131	1
resp. 3	0.028	0.034	0.041	0.112	0.076	0.137	0.075	0.075	0.204	0.051	0.167	1
resp. 4	0.042	0.027	0.02	0.04	0.045	0.021	0.068	0.079	0.047	0.267	0.344	1
resp. 5	0.231	0.042	0.131	0.093	0.138	0.102	0.054	0.025	0.076	0.049	0.059	1
resp. 6	0.289	0.177	0.113	0.097	0.101	0.077	0.043	0.019	0.027	0.034	0.027	1
resp. 7	0.273	0.17	0.131	0.098	0.1	0.078	0.043	0.018	0.027	0.033	0.029	1
resp. 8	0.289	0.177	0.113	0.097	0.101	0.077	0.043	0.019	0.027	0.034	0.027	1
resp. 9	0.025	0.138	0.044	0.102	0.038	0.051	0.097	0.233	0.069	0.107	0.097	1
resp. 10	0.061	0.24	0.255	0.041	0.034	0.139	0.08	0.033	0.095	0.013	0.01	1
average:	0.166	0.127	0.12	0.078	0.074	0.083	0.064	0.066	0.062	0.07	0.09	1

The symbols k^j indicate the fulfillment of criteria A, B, C, D, which take values from the interval [0, 1].

$$k^j = \frac{1}{v^j} \sum_{i=1}^3 k_i^j v_i^j, \text{ where } j \in \{A, B, C, D\}. \tag{4}$$

The overall fulfillment of criteria, i.e. the current state of providing cooperation by the Army of the Czech Republic in rescue and liquidation work in the regions, was obtained as a weighted average despite the fulfillment of individual criteria in the form of:

$$k = \sum_{j \in \{A, B, C, D\}} k^j v^j = k^A v^A + k^B v^B + k^C v^C + k^D v^D = 0,714. \tag{5}$$

Or also equivalently in the form of a weighted average across all indicators.

$$k = \sum_{j \in \{A, B, C, D\}} \sum_{i=1}^3 k_i^j v_i^j = 0,714. \tag{6}$$

The proposed procedure uses a set of identified criteria and indicators, which will allow to assess the activities and the coordinating role of the army in civil-military cooperation with a higher degree of objectivity.

The resulting fulfillment of the criteria is shown in Table 7. The following intervals were chosen to determine the value of fulfillment of the individual criteria, based on brainstorming with 20 experts:

- 1–0,9 – fulfilled;
- 0,89–0,63 – fulfilled with restrictions;
- 0,62–0 – unfulfilled.

The research shows that all criteria are only partially fulfilled. A discussion of the achieved results is presented in the following chapter.

5. Discussion

The fulfillment of individual criteria is not possible to measurable in an exact way. The evaluators responded on the basis of their professional experience resulting from dealing with emergencies of a naturogenic nature, such as large-scale floods (Czech Republic, 1997; 2002, 2012) and in dealing with the current COVID-19 pandemic. However, these experiences cannot be quantified. This is the reason why the Saaty method was used to analyze the fulfillment of individual criteria. It enables to find the values that correspond to reality the best. However, the

Table 6. Weights of criteria.

Criterion	Indicators for criteria fulfillment	Weights of indicators	Weights of criteria
A	I_1^A	$v_1^A=0.166$	$v^A = 0.41$
	I_2^A	$v_2^A=0.127$	
	I_3^A	$v_3^A=0.120$	
B	I_1^B	$v_1^B=0.078$	$v^B = 0.24$
	I_2^B	$v_2^B=0.074$	
	I_3^B	$v_3^B=0.083$	
C	I_1^C	$v_1^C=0.064$	$v^C = 0.19$
	I_2^C	$v_2^C=0.066$	
	I_3^C	$v_3^C=0.062$	
D	I_1^D	$v_1^D=0.07$	$v^D = 0.16$
	I_2^D	$v_2^D=0.09$	
sum of weights:		1	1

results obtained in this way cannot be compared with the experience of the evaluators according to which they were determined.

Using the Saaty's method and a questionnaire survey, it was found that criteria A (Human resources) and B (Technical security of the allocated forces) are given the highest weight by the respondents (Adamo-niene, 2018). At the same time, however, these criteria are fulfilled just above the set level of fulfillment. The lower fulfillment of criteria A and B could be negatively affected by a higher number of respondents from the tactical level of command and control of the ACR, who have the allocated F&R in direct subordination. It follows from the above that they have a better overview of the real state of manpower and technology than the respondents from the operational and strategic level. Respondents from this level only keep reports on the numbers of technology and manpower. Respondents gave the lowest weight to criteria C (Command and control of allocated forces) and D (Planning the deployment of the F&R of the ACR). Nevertheless, these criteria, compared to criteria A and B, are fulfilled more, almost by one point. The values obtained by the research show that officers at all levels of the ACR command and control see room for improvement in all areas examined. For possible follow-up research, it would be appropriate to obtain a wider sample of respondents from all levels of command and control of the ACR. It would also be appropriate to involve members of the ACR who are not included in senior positions. Follow-up research would be appropriate at least one year after the current measures to manage the consequences of the COVID-19 pandemic.

One of the consequences of the partial fulfillment of the criteria is the proposal of changes aimed at its increase. Proposals for changes to criterion A, to which the respondents gave a higher weight than to criteria C and D combined, are evident in the area of increasing unit preparedness, for example by including non-military operations in training programs for almost all types of forces. At present, there is very little room for education and training in non-military operations within the training of the main activities of individual types of forces (Tušer, 2020). Furthermore, it is appropriate to include training in non-military operations in career courses of officers. If units and command officers are prepared, it will also be possible to allocate more forces, if necessary, and ensure better fulfillment of criterion A.

Table 7. Total fulfillment of criteria.

Criterion	Total fulfillment	Evaluation
A	0.688	Fulfilled with restrictions
B	0.694	Fulfilled with restrictions
C	0.781	Fulfilled with restrictions
D	0.765	Fulfilled with restrictions

In order to improve the fulfillment of criterion B, investments are mainly needed in transport equipment, as well as in special heavy equipment designed for earthworks, in ensuring the passability of roads and recovering vehicles. For the purchase of this equipment, it is necessary not only to allocate financial resources, but also to streamline legal norms for the acquisition of property and services for consideration in crisis situations.

Under criterion C, the command and control system was identified by the respondents as being able to respond flexibly to situations. However, the respondents gave a lower assessment of its fulfillment, because the verification of this system in non-military crisis situations takes place using simulation and training technologies, which are not linked to the actual maneuver of forces and resources. The involvement of a real maneuver of these forces in simulation exercises would improve the fulfillment of criterion C. A further increase in efficiency, within this criterion, would bring legislative changes enabling the establishment of a uniform information flow for all IRS units.

Criterion D was analyzed last. According to the respondents, this is one of the most fulfilled criteria, and at the same time they give it the least importance. The planning and management documentation depends mainly on the correct identification of risks for which the F&R of the army will be predetermined and prepared. Based on the deployment of the F&R of the ACR during the covid-19 pandemic, there will be a partial revision of these risks. Another proposal is that the person processing the crisis documentation should also be actively involved in its eventual implementation by the F&R of the ACR.

Literature research and an examination of the current situation in the Czech Republic, the V4 countries and other EU Member States revealed that the legislation and the specialized literature do not define criteria for assessing the level of fulfillment of individual areas of emergency preparedness in civil-military cooperation. Due to its focus (collective defense), the NATO Alliance has a sophisticated system for assessing combat readiness (Combat Readiness Evaluation - CREVAL, Tactical Evaluation - TACEVAL, etc.), but it does not assess the level of emergency preparedness in the field of civil-military cooperation. Each Member State has civil protection forces under a different ministry. In some states, the civil protection forces fall under the Ministry of the Interior, elsewhere under the Ministry of Defense, or, as in the Czech Republic, these forces fall under the General Directorate of the Fire and Rescue Service, and others. It is therefore not possible to coordinate these forces effectively within NATO (NATO, 2001).

In the Joint Doctrine Publication (Ministry of Defense GOV UK, 2016) published by the British government, the Monitoring and Evaluation section is devoted to a humanitarian response to a disaster, including military contribution, but does not address evaluation criteria determining the required level of emergency preparedness of stakeholders for civil-military cooperation. In the presented area, usually only the "Lessons learned" system is used.

Extended discussion Based on the acquired knowledge (lessons learned) from already solved non-military emergencies, the authors of paper (Tatham et al., 2012) present the Defense Lines of Development (DLOD) framework. This framework is used by the UK Department of Defense, in particular for acquisition and acquisition planning. The Framework sets out 9 standards (e.g. Concepts & Doctrine, Equipment, Logistics, Personnel, Training, etc.) to assist in the discussion of natural disaster preparedness, planning and response strategies (Tatham et al., 2012; Ministry of Defense GOV UK, 2010). These standards represent individual areas that the military must not forget in successful disaster management. Nevertheless, there are no weights for individual standards that would determine the level of their fulfillment, as proposed in our paper.

Oravec and Beadling (2015) present the Disaster Preparedness Program (DPP), which is a partnership between The Center for Disaster and Humanitarian Assistance Medicine (CDHAM) and the United States African Command (USAFRICOM) and the United States Africa Command. The aim of the DPP is to help to improve the disaster preparedness and

response capabilities. The program emphasizes the importance of a government-wide approach to disaster preparedness and response, especially in the area of planning. As a result of this program, ten African countries have developed national influenza preparedness and response plans. Seven countries have used the plan to prevent the spread of Ebola. Several African armies have developed contingency plans for "military support to civilian authorities," and one army has used this approach at Ebola. Several African armies have drafted "military support to civil authorities" disaster contingency plans, and one army has used this approach with Ebola (Oravec et al., 2015). The advantage of the presented study is that to identify possible shortcomings in the plans, a disaster simulation exercise was carried out with representatives of agencies and ministries involved in disaster response. The result of the exercise was a final contingency plan that the partner nation can use to set priorities and address their immediate needs. Crisis planning in preparation for resolving non-military crisis situations with the help of the F&R army can then also be evaluated or updated through our proposed criterion D: Planning the deployment of F&R. Indicators with a value of performance were also set for this criterion, and with a certain modification for the given area and culture it can also be applied.

Factors influencing the success of civil-military coordination in natural disasters were addressed, inter alia, by the authors of the qualitative study in Iran in 2019 (Araghizadeh et al., 2020) through interviews with experts. The data were analyzed using thematic analysis in order to extract the factors influencing the civil-military coordination in natural disasters in Iran. At the end of the study, factors influencing the coordination between military and civilian organizations into personnel, material and systemic matters were categorized. In addition, 33 subcategories were identified. As one of the results it is emphasized that the organization of training courses and regular exercises can improve the coordination of stakeholders in response to disasters (Araghizadeh et al., 2020). This fact is also pointed out in our study. Recognition of criteria that affect coordination can be effective in accordance with emergency management during natural disasters.

Regarding the point of limitation of the research, it can be stated that the authors find it mainly in differences of opinion and perception of the evaluated criterion by individual respondents. For each respondent, based on his/her opinion (data), the weights of criteria and their indicators were calculated. These weights were averaged and then the total weight was obtained, determining the significance of the criterion. The average is the best estimate of the mean value, but at the same time it does not take into account the distribution of individual data determined by the respondents (influenced by differences of opinion and perception). Some authors deal with this problem by using fuzzy sets (Chang et al., 2015; Neff, 2013; Ravallion, 2010).

6. Conclusion

The main contribution of the article is the creation of a procedure for determining the degree of preparedness in the area of cooperation of the army with civilian units in resolving an emergency event. As part of this procedure, evaluation criteria were proposed to assess the level of emergency preparedness of the army for dealing with non-military emergency events. One of the tools used to assess the significance and

fulfillment of the above criteria was the Saaty's method. The outcome of the applied methods is determining the overall fulfillment of individual criteria affecting the level of emergency preparedness of the ACR. The results of the fulfillment of the criteria, presented in Table 7, point to the need to improve the army in the described areas. The current state of the determined level of emergency preparedness of the ACR, "Fulfilled with restrictions", may result in a longer response to the solution of the emergency event and lower efficiency in the implementation of rescue work.

The conducted research investigation revealed shortcomings in the current state of forces and resources in providing cooperation in crisis situations of a non-military nature in the Czech Republic. A more reliable and precise specification of the real needs and requirements for the F&R of the ACR, demanded by the IRS units and emergency management authorities, is essential for the effectiveness of rescue work. The aim of follow-up research may therefore be to identify the specific needs and resources of all crisis management stakeholders at the regional level.

To further increase the effectiveness of providing cooperation of the ACR in rescue and liquidation work in the regions, it may be appropriate to use the knowledge presented in this paper to develop a uniform methodology for requiring the F&R of the ACR by emergency management authorities at the regional level.

The proposed procedure uses a set of identified criteria and indicators which, with a higher degree of objectivity, will make it possible to assess the level of emergency preparedness of the army for civil-military cooperation.

Declarations

Author contribution statement

Irena Tušer: Contributed reagents, materials, analysis tools or data; Wrote the paper.

Jiří Jánký: Conceived and designed the experiments; Analyzed and interpreted the data.

Antonín Petrás: Performed the experiments.

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Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendix 1

Table A1. Saaty matrix-example.

	I_1^A	I_2^A	I_3^A	I_1^B	I_2^B	I_3^B	I_1^C	I_2^C	I_3^C	I_1^D	I_2^D	s_i	$\sqrt[3]{s_i}$	weights
I_1^A	1	3	3	3	1	3	5	7	3	5	5	212625	3.05	0.231
I_2^A	1/3	1	1/3	1/3	1/3	1/3	1/3	3	1/3	1	1	0.00137	0.549	0.042
I_3^A	1/3	3	1	3	1	1	3	5	1	3	3	405	1.73	0.131
I_1^B	1/3	3	1/3	1	1	1	3	3	1	3	1	9	1.22	0.093
I_2^B	1	3	1	1	1	1	3	3	3	3	3	729	1.82	0.138
I_3^B	1/3	3	1	1	1	1	3	3	1	3	1	27	1.35	0.102
I_1^C	1/5	3	1/3	1/3	1/3	1/3	1	3	1	1	1	0.0222	0.707	0.054
I_2^C	1/7	1/3	1/5	1/3	1/3	1/3	1/3	1	1/3	1/3	1/3	0.00000435	0.326	0.025
I_3^C	1/3	3	1	1	1/3	1	1	3	1	1	1	1	1	0.076
I_1^D	1/5	1	1/3	1/3	1/3	1/3	1	3	1	1	1	0.0074	0.64	0.049
I_2^D	1/5	1	1/3	1	1/3	1	1	3	1	1	1	0.066	0.782	0.059
sum													R=13.174	1

For this matrix the $\lambda_{max} = 11.67$ and we get

$$\frac{\lambda_{max} - n}{n - 1} = \frac{11,67 - 11}{10} = 0,067 < 0,1. \tag{8}$$

Thus, the condition guaranteeing that the given matrix is sufficiently consistent is fulfilled and we can use it to process the Saaty method.

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