

Strategies for Civil-Military Geographical Support to Defence and Security Operations

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doi: 10.5281/zenodo.11584899

Abstract: The possibilities offered by modern GIS and remote sensing technologies provide great opportunities for their dual purpose. The availability of applications, materials as well as appropriate training and literature makes them relevant in geographic intelligence support to military operations (GEOINT). Even usage of the open sources, such as Copernicus and USGS, enable limited operationalization in area survey and detection of changes with significant potential for education and training of the expert staff. In order to make the best use of this potential, a significantly improved civil-military cooperation is needed, whereby defence and security organizations are given the opportunity to acquire professional knowledge from the relevant scientific fields, and academic and private partners are enabled to acquire knowledge and practical experience in the skills and organization of military operations. This work, using the method of multi-criteria analysis, an objective comparison of available strategies are made. The result of the applied multi-criteria analysis favours a permanent, integrated civil-military organization with a high degree of coordination and interoperability based on the existing organization of state ministries, without the need to establish new specialized institutions.

Keywords: GEOINT; dual-use; remote sensing; multi criteria analysis.

1 Introduction

The modern geospatial environment is characterized by complexity that requires mastering of significant IT capabilities. It is a favourable circumstance that modern technologies for the analysis of geospatial information in support of military operations (GEOINT) are at a high level of development and are widely available. GEOINT was created for military needs, through the process of intelligence preparation of the battlefield, and the developed methods and procedures found great use in civilian applications. Civilian and military experts jointly participated in their development, so GEOINT is one of the best examples of their synergy and dual use.

Continuous training of GEOINT specialists is enabled through NATO and the EU, and available open sources, although they provide limited operational GEOINT capabilities, it still has great opportunities for research and development of new methods to support GEOINT training at the national level. Currently, significant national capabilities for GEOINT are scattered across segments and levels of society, there are no national strategic and doctrinal documents for the development of this capability, nor integrated training programs at the

necessary levels of expertise (Viher 2021). Situations of natural and technical disasters encourage us to improvise and ad-hoc solutions whose positive experiences are forever lost in the absence of a system of lessons learned for GEOINT. The main objective of the text is a suggestion of integrating existing national capabilities in the way of the most effective strategy. An example of a dual-use GEOINT product is shown on the Figure 1.

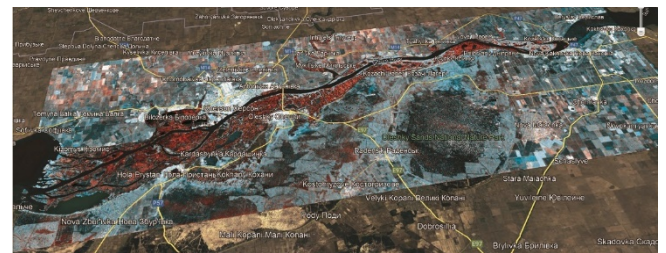


Figure 1. An example of dual-use GEOINT product; change detection of the Sentinel-1 satellite Synthetic Aperture Radar (SAR) imagery after demolition of the Novaja Kahovka dam on June 6, 2023, scattering coefficient difference shows flooded areas (red), two SAR-s were compared (Google Maps as the base layer).

2 Materials and methods

Using the BOCR (Benefits-Opportunities-Costs-Risks) framework for the analytical network process, the gains, opportunities, costs and risks of five alternatives were analysed, all were ranked by success in the BOCR synthesis, and their success rates were also quantitatively compared. A hybrid network and hierarchical structure runs through the entire model; in the BOCR framework, the criteria are connected in a network, while the alternatives under them are in a hierarchical relationship (Figures 2 to 5).

Benefits (Figure 2) are the basic functions and purpose of GEOINT; support for operations carried out by military and security organizations and institutions, concept development and experimentation (CD&E) for the future development of capabilities as new technologies and doctrines are introduced, international activities (bilateral and multilateral; NATO and EU) and participation in higher education in order to maintain capabilities through the expert education of one's own staff.

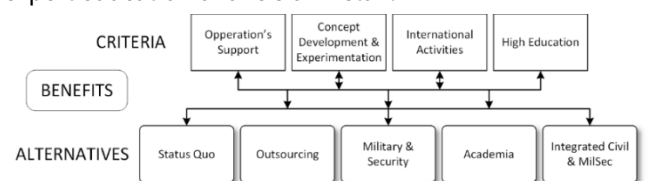


Figure 2. Benefits have four criteria among five alternatives.

Alternatives differed most across opportunities (Figure 3, Table 2). Opportunities represent the possible organizational and personnel superstructure of GEOINT. Initiating and participating in scientific research projects is an easily achievable upgrade. Advisory and consultation at the strategic level contributes to decision-making at the highest level as well as to the long-term national development of GEOINT as a dual-purpose discipline. Attracting experts and the possibility of establishing centres of excellence contribute significantly to the personnel quality and sustainability of the GEOINT system. A significant opportunity for personal development is the possibility of attracting and developing reserve officers - Subject Matter Experts (SME) for GEOINT, who will undergo parts of military training for: intelligence tasks, work in headquarters and knowledge of the processes of military decision-making, although they do not have the authority to command. The most important opportunity is the creation of interministerial cooperation through the systematic and solid connection of the responsible ministries: defence and security, internal affairs, science, economy and EU funds.

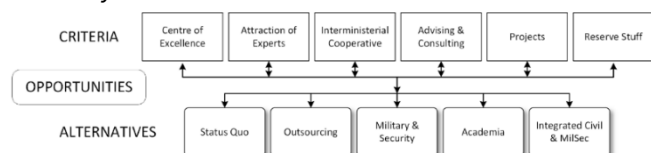


Figure 3. Opportunities have six criteria among five alternatives.

Costs are tracked through necessary investments in equipment, data, projects and personnel (Figure 4). In this paper, the costs are compared qualitatively, but they can also be expressed quantitatively in future detail assessments.

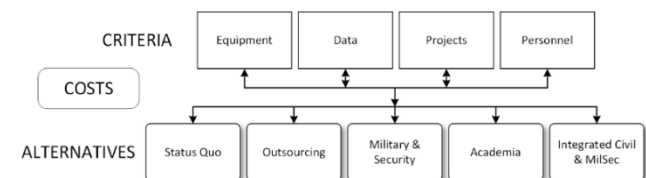


Figure 4. Costs are considering four generic criteria based on qualitative scales.

Among the five alternatives, the risks can be divided into: impossibility and inadequate equipping of the GEOINT system, failure of attracting and retaining personnel, impossibility of realizing projects due to material or organizational deficiencies, and security risks from foreign intelligence activities (Figure 5).

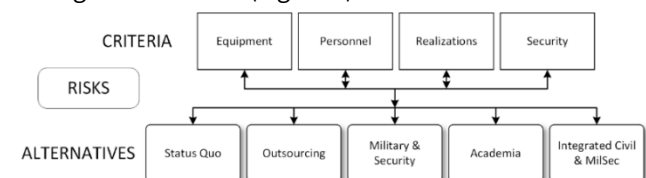


Figure 5. Risks are considered over four generic criteria.

In the search for an optimal strategy of GEOINT support for military operations, the former positive experience of cooperation with civilian factors (academia, public institutions and the enterprises) was included, as well as the complementarity of existing capabilities. Five

strategies for GEOINT support to military operations are assumed in the paper. At one extreme, they extend from the maintenance of the existing state (Status Quo) in which GEOINT is at the stage of rudimentary development, dependent on enthusiasm and the ability to improvise, but almost completely outside the existing NATO strategies, doctrines, standards and standard operating procedures. The next strategy is outsourcing, where there are no development and organization costs, but product prices are extremely high, there is no accumulation of knowledge in the system, and the security risks are the greatest in that case. The strategy of leaving GEOINT to the academic community opens up access to new methods and technologies, as well as an out-of-the-box way of thinking. At the same time, the social networks of experts are expanding significantly, attracting young people interested in GEOINT, which is a prerequisite for the future establishment of reserve officers' corps. The negative side of this strategy is that a wide and heterogeneous mass of experts represents a security challenge. Assigning the GEOINT development strategy to the Ministry of Defence and the Ministry of the Interior, with the professional support of the relevant departments of science and economy, has its advantages in better defining the needs of the Armed Forces, the highest level of military-security expertise and the best security of processes, personnel and infrastructure.

3 Results

Already developed ANP-BOCR methods were used in the work, we refer the reader to the original works of the founder of this method (Saaty and Vargas 2013) Tables 1 to 4 compare the criteria (ANP) and then the alternatives according to the layer of criteria (AHP). Saaty's importance ratings were used; 1 = equal, 2 = weak, 3 = moderate, 4 = moderate plus, 5 = strong, 6 = strong plus, 7 = very strong, demonstrated, 8 = very, very strong and 9 = dominating and their reciprocal values. In all cases inconsistency must be lower than 0.1.

The best alternatives in benefits and opportunities carry with them the highest estimated costs (Table 3). The ANP-BOCR method enables a good balancing of gains and investments although it is not a method for planning and optimizing GEOINT capability budgets.

Similar to the COSTS criteria the RISKS criteria (Table 4) have the same assessments between the alternatives and the criteria so both Tables 3 and 4 are quite simple.

The outcome of the BOCR model ($B \cdot O$) / ($C \cdot R$) (Saaty, 2013) finds the integrated civil-military coordination among responsible ministries and well-connected institutions and organizations – tied to mutual, preferably international, projects and activities. The second ranked alternative; GEOINT under full responsibility to national defence and security have just 41% of success of the best ranked alternative. The worst alternative of the Status Quo maintaining clearly shows that in the case of integrated civil-military cooperation in the GEOINT we will have the progress of two orders of magnitude.

Table 1. Relative importance of the criteria and alternatives in benefits.

Benefits - Inconsistency 0.016290	High education	International activities	Operational support	
CD&E	1	5	1/3	
High education		5	1/3	
International activities			1/5	
wrt CD&E - Inconsistency 0.08553	Integrated	MIL&SEC	Outsourcing	Status quo
Academia	1/7	1/3	1	5
Integrated		5	7	9
MIL&SEC			5	7
Outsourcing				4
wrt High education - Inconsistency 0.08465	Integrated	MIL&SEC	Outsourcing	Status quo
Academia	1/5	2	5	7
Integrated		5	7	9
MIL&SEC			4	7
Outsourcing				3
wrt International act. - Inconsistency	Integrated	MIL&SEC	Outsourcing	Status quo
Academia	1/5	1/3	1	6
Integrated		5	6	9
MIL&SEC			4	7
Outsourcing				3
wrt Operat. support - Inconsistency	Integrated	MIL&SEC	Outsourcing	Status quo
Academia	1/7	1/6	1/2	1/3
Integrated		3	7	9
MIL&SEC			5	5
Outsourcing				2

Table 2. Relative importance of the criteria and alternatives in opportunities.

Opportunities - Inconsistency 0.07731	Attract. of experts	Centre of excel.	Interminist. cooperat.	Projects	Reserve stuff
Advising & consulting	1/4	1	3	3	2
Attraction of experts		1	3	3	2
Centre of excellence			5	4	5
Interminist. cooperative				1/3	1/2
Projects					2
wrt Advising and Consult. - Inconsistency	Integrated	MIL&SEC	Outsourcing	Status quo	
Academia	1/5	1/3	1	5	
Integrated		4	6	9	
MIL&SEC			4	7	
Outsourcing				4	
wrt Attraction of exper. - Inconsistency 0.05874	Integrated	MIL&SEC	Outsourcing	Status quo	
Academia	1/4	3	1	5	
Integrated		5	5	9	
MIL&SEC			1	5	
Outsourcing				6	
wrt Center of excellence - Inconsistency 0.06968	Integrated	MIL&SEC	Outsourcing	Status quo	
Academia	1/5	2	2	6	
Integrated		5	5	9	
MIL&SEC			3	5	
Outsourcing				4	
wrt Interministerial co. - Inconsistency 0.06814	Integrated	MIL&SEC	Outsourcing	Status quo	
Academia	1/5	1	4	5	
Integrated		6	7	9	
MIL&SEC			5	7	
Outsourcing				2	
wrt Projects - Inconsistency 0.07067	Integrated	MIL&SEC	Outsourcing	Status quo	
Academia	1/5	3	1	6	
Integrated		5	6	9	
MIL&SEC			1/3	4	
Outsourcing				5	
wrt Reserve stuff - Inconsistency 0.06743	Integrated	MIL&SEC	Outsourcing	Status quo	
Academia	1/7	1/5	1	3	
Integrated		5	6	9	
MIL&SEC			5	7	
Outsourcing				2	

Table 3. Relative importance of the criteria and alternatives in costs.

Costs - Inconsistency 0.05770	Equipment	Projects	Stuff	
Data	2	3	1/3	
Equipment		4	1/2	
Projects			1/6	
wrt Costs criteria - Inconsistency 0.085530	Integrated	MIL&SEC	Outsourcing	Status quo
Academia	1/3	3	3	7
Integrated		5	4	9
MIL&SEC			1	7
Outsourcing				5

Table 4. Relative importance of the criteria and alternatives in risks.

Risks - Inconsistency 0.05810	Realization	Security	Stuff	
Equipment	1/2	1/5	1/4	
Realization		1/3	1/2	
Security			1	
wrt Risks criteria	Integrated	MIL&SEC	Outsourcing	Status quo
Academia	3	3	1/3	1/7
Integrated		1	1/6	1/9
MIL&SEC			1/6	1/7
Outsourcing				1/3

Table 5. The outcome of the BOCR model highly favours the integrated strategy.

	Raw	Normalized	Ideal	RANK
Integrated	13.9949	0.6740	1.0000	1 st
MIL&SEC	5.7507	0.2769	0.4109	2 nd
Academia	0.6713	0.0323	0.0480	3 rd
Outsourcing	0.2678	0.0129	0.0191	4 th
Status quo	0.0805	0.0039	0.0057	5 th

4 Discussion and conclusions

The most developed strategy is represented by an integrated model of military-civilian cooperation that fully utilizes existing national resources and does not require the opening of new organizations and institutions. In that strategy, the emphasis is on developed and sustainable interdepartmental cooperation and on a joint national strategy for GEOINT.

In addition to active participation and promotion of an integrated model of national GEOINT on conferences such as ICERS, it is necessary to take practical steps to identify and connect future stakeholders in the activities. In this sense, it is necessary for the Republic of Croatia to join the international activities offered by the initiatives of the EU (European Defence Agency, Sat Centre, Horizon Europe, etc.) and NATO (Science and Technology Organization, Science for Peace, ACT-CD&E, etc.). One of the first steps should be the signing of the Charter on Space and Disasters

by the responsible Ministry of Internal Affairs, this step will significantly speed up the processes of civil-military integration.

Acknowledgments: Author wish to express gratitude to the Super Decisions Foundation (www.superdecisions.com) for free use of the Super Decisions 3.2.0 application used for this work.

5 References

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