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THE COMPETING HYPOTHESES ANALYTICAL MODEL AND HUMAN INTELLIGENCE SINGLE-SOURCE ANALYSIS

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Abstract: The article examines some particular aspects of the analytical process within the intelligence cycle, having as reference the framework of strategic intelligence. Starting from a proposed model of analysis of the competing hypotheses using phases-tailored tools, which will improve the quality of all-source intelligence analysis and its final products, we further assess its applicability in HUMINT (Human Intelligence) analysis. The model of intelligence analysis as a problem-solving method, with a focus on predictive analysis, will serve to understand the expectations from single-source collection disciplines (in our case, HUMINT) data gathering and reporting, connected to the roles of HUMINT analysts in the specialized branches.

Keywords: Information, Intelligence, HUMINT, analysis

1. Introduction

Information throughout the history of conflicts has been a desirable commodity, and possession of timely and relevant information has been a factor in deciding the winner on the battlefield. Having information is one step but analyzing it correctly and interpreting it in context is the second step and challenge.

The critical assessment of professional publications and NATO references on intelligence analysis, with an emphasis on processing methodology for long-term forecasts at the strategic level of intelligence, is a necessary step in our evaluation.

The aim of the query is not only to understand the current state of knowledge on the subject of research but also to understand the logic of the process and thus to obtain the prerequisites for optimizing and adapting the analysis process.

Further, we apply the model in a HUMINT context, inquiring about its utility from the perspective of single-source collection discipline.

The article offers an answer to the research question: what steps make up the optimal process of intelligence analysis, and which is the acquaintance of all-source and singlesource analysis to this model?

The object of the research is the intelligence analytical process, having as subject the method of its dismemberment into individual phases. The second stage in our approach is related to the particularization of the proposed model to HUMINT, which particular emplovs practice in the information assessment/ analysis.

When examining the subject of the article, we have used the method of qualitative

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content analysis of public documents and professional publications, to define the problem and describe the current state of knowledge.

Modeling the analytical process was another meaningful approach, enabling its simulation from the HUMINT perspective.

2. The state of the solution of Intelligence analysis in the framework of NATO's doctrinal environment

Conceptually, there is a key difference in the approach of Intelligence analysis. On one side, from the U.S. particular perspective, it is seen as an Intelligence warfighting function: *a process by which collected information is evaluated and integrated with existing information to facilitate*

intelligence production [1], phased in the stages of screening the collected information, analyzing, integrating it, and producing Intel. On the other side, NATO, and most of the allied nations, place analysis as a component of one of the steps – *processing* – in the intelligence cycle (fig. 1).

Intelligence involves the use of various activities, methods, technology/ sensors, mechanisms, and procedures of obtaining data and information from various sources, and a blended use of human assets and technical means in working with information in the various stages of the intelligence cycle.



Processing

Figure 1: The components of Intelligence Processing within the Intelligence Cycle Source: JDP 2-00, Figure 3.5

intelligence Overall, represents the organized and systematic efforts of the commander and his staff obtain to information enabling operational environment understanding, threats assessment, and operations conduct.

In any of the contexts, intelligence should be forward-looking, enabling commanders to maintain the initiative in various courses of action (based on predictive assessments).

2.1. Intelligence analysis in doctrines and service manuals

In assessing the current state of research in intelligence analysis, we have focused on NATO's approach for primary reference, and the dedicated US Army techniques publication, as well as other scientific papers dealing with intelligence analysis, for an in-depth approach.

NATO defines analysis – in intelligence usage – as a *step in the processing phase of*

the intelligence cycle in which information is subjected to review in order to identify significant facts for subsequent interpretation. [2] This definition is further taken by the NATO's keystone Allied Joint Doctrine for Intelligence, Counter-Intelligence and Security (AJP-2) and the Allied Joint Doctrine for Intelligence Procedures (AJP-2.1), which describe the analytical process as the basic activity that turns information into intelligence, by processing collated and evaluated information to identify significant facts, corroborate them with other known facts and subsequently draw deductions. It also refers to intelligence tools in support of analysis in specific sub-areas, for example in the Joint Intelligence Preparation of Operational Environment.

Overall, NATO doctrines emphasize the fact that analysis is never complete and is not 100% sure or certain, due to the dynamics of most crises, their complexity, and unpredictability. However, the effective analysis can help the commander to reduce the level of uncertainty, building the operational image from pieces of various degrees of credibility.

The analysis is not just about the current situation, it should have a strong predictive dimension, modeling alternative paths of situation development based on logical assumptions about the actions and reactions of different actors (including the impact of any outer intervention).

In the end, the U.S. Army publication for Intelligence Analysis (ATP 2-33-4/ Jan. 2020) treats the intelligence analysis as a process by which information is evaluated and integrated into an image consisting of information already obtained to create an intelligence product that describes the current state and seeks to predict the future state of the operating environment, enemy and threats, and their impact on operations. It is a controlled, systematic, and consistent approach to problem-solving that assists intelligence analysts and staff in drawing accurate, objective, and unbiased conclusions and assessments [3].

3. The Intelligence analytical process

The intelligence analysis can be understood in two levels.

At the micro-level, it is associated with the qualitative and quantitative processing of every single piece of information during the transformation into intelligence information, and subsequently to be integrated into intelligence assessment. It can be generally defined as a method that involves the breakdown of a certain input problem into other sub-problems and their relationships, which are considered simpler than the input problem and are its parts, form its structure and are its causes and can be deductively deduced from them. [4]

At macro level, we understand the analysis as part of a system process, where the input is the assignment by a customer, followed by information requests processing, and concluding with final intelligence product, enclosing assessments and predictions in various dissemination forms. [5]

Intelligence analysis is the process by which information gathered is evaluated and integrated with existing information in order to produce intelligence that describes the current situation and attempts to predict the future impact of the threat, enemy, terrain, weather, and civilian aspects of space on the operation. It is a disciplined and consistent approach to problem-solving that helps analysts or intelligence specialists making accurate and unbiased in conclusions. based available on information.

In the armed forces, intelligence analysis focuses on the process of Intelligence Preparation of the Operational Environment and its equivalents at the operational and strategic level, applied during the military decision-making process [6], and other relevant tasks along with the operation execution (fig. 2). In this respect, Intelligence analysis helps generate additional information requirements and partially overlaps information gaps with expert estimates and predictions [7].

Inputs:	Analytical processes				
focus, sensor, kind of source		Time factor	Single source	All source	Outputs
Intelligence collection disciplines	Partial analysis	Short-	spatial analysis		Specialized Intel
		term/	threat analysis		products
			human network analysis		
			etc.		
	Comprehensive analysis*	Long- term	Problem- solving analysis	Diagnostic and advanced analysis**	Summary Intelligence
* Comprehensive analysis may include sub-processes of partial analysis.					
** All-source analytical tasks IAW ATP 2-33.4, chapter 3:					
Perform IPB					
Provide warnings.					
Perform situation development.					
• Provide intelligence support to targeting and information operations.					

Figure 2: Typology of intelligence analysis

Adaptation of: Tvaruška, 2021, Spravodajský analytický proces v OS SR (part 2). Liptovský Mikuláš: Akadémia ozbrojených síl generála M.R. Štefánika, 2020. Pre-print

framework of scientific Within the methods, intelligence analysis can be seen as a continuous process of discovering building suppositions, evidence, and validate them as reflected by an unstable, evolving environment, which involves various collaborative processes of dealing with evidence in order to create hypotheses, evidence-seeking hypotheses, and probative hypothesis testing. All these processes are complex [8] and involve a combination of basic thinking abilities (information ordering, pattern recognition, and reasoning), critical and creative thinking [9].

3.1. Basic terms in the field of Intelligence analysis

Analysis in Intelligence represents a set of methods and tools (a model of structured analytical techniques can be consulted in ATP 2-33.4, chapter 4) used in sorting of the obtained and evaluated information in order to separate the essential elements, compare and determine the relative importance of information with consideration of already known information and intelligence information and next, determining the likely significance of evaluated intelligence.

In doing so, analysts consider the information source's reliability and the information accuracy, which is especially important in the nowadays' informational spectrum, plagued by active deception and manipulation.

From this perspective, we can understand analysis as a way to reduce the level of uncertainty in an uncertain environment, as the operating environment is. The role of intelligence analysis in the commander's support is to select and highlight information that is vital to decision making. Each such piece of intelligence information or assessment consists of known confirmed facts, which are considered based on expert knowledge of analysts to make certain probabilistic statements about the meaning and certainty of the information (in qualitative terms, ranging from *remote* – or *highly unlikely* – to *almost certain* [10], in order to further enable predictions. The predictive attribute of analysis shapes trends and configure hazards, seeking to outline development alternatives of future threats, terrain and weather conditions, or any other aspects affecting the operational environment.

3.2. A model for the Intelligence analysis process

Analysis is an intellectual process, where the whole is divided into smaller parts to study them individually. In intelligence, this term is used in a broader sense; it means not only the division into parts but also their reconnection into some meaningful whole, so that, in principle, intelligence analysis also includes the subsequent synthesis.

The trigger of the analytical process is a request for information or an information query of the final consumer. Correct understanding of the assignment is crucial for the entire analytical process, from which understanding the direction of information collection and processing of the final product is derived.

An intelligence analyst very rarely has direct access to an observed or evaluated object of interest; he/she obtains information indirectly. Based on the information obtained in this way and after evaluating the initial requirement, using scientific and logical methods, preliminary evaluations or hypotheses are generated for a given phenomenon or object of analysis [11].

However, NATO is not prescriptive in defining a standard working algorithm for analysis, advancing multiple ways to trade information.

In the analysis of competing hypotheses, each of them is examined based on probability and compared in the context of newly acquired information, in an effort to obtain a valuable conclusion.

By researching information in existing databases, the analyst identifies information gaps and information needs that are transformed into information collection plans through Information Requirements Management and Collection Management. Information coming from the employed sources is then assessed against several criteria, such as relevance, reliability. credibility, relevance, and the possibility of the information being deceitful. The information evaluated in this way becomes evaluation factors for weighting individual hypotheses. The result of this process is a ranking of relevant hypotheses with the determination of the most probable vs. inconsistent assumptions.

Further, the processed and evaluated hypotheses become the basis for the processing of the final evaluation and are presented in a specified form to the final user of the intelligence and incorporated into the overall intelligence picture of the situation [12].

Based on the results of content analysis, a model for intelligence analytical process based on competing hypotheses consists of the next phases: (figure 3)

- problem definition,
- hypothesis generation,
- identification of information gaps and information collection,
- evaluation of sources,
- hypothesis testing,
- evaluation, and
- ongoing monitoring.

The proposed model offers a reinterpretation of the consecrated algorithm described by R. J. Heuer jr. in *"Psychology of Intelligence Analysis"* (figure 4).



Figure 3: The Intelligence analytical process

Source: TVARUŠKA, P. 2020. Spravodajský analytický proces v OS SR (part 1) Liptovský Mikuláš: Akadémia ozbrojených síl generála M.R. Štefánika, 2020. Figure 3, Intelligence analytical process; p. 252.



Figure 4: Analysis of competing hypothesis Based on: Heuer, Richards J., Jr, Psychology of Intelligence Analysis, Center for the Study of Intelligence, Central Intelligence Agency, chapter 8

The goal of the analysis of competing produce the hypothesis is to best interpretation of information from uncertain data. Analysts resume the analysis by drawing conclusions that answer hypotheses (auestions) they have established in the problem definition stage or delivering just initial determinations that need additional collection and/ or analysis.

The next efforts focus on testing and validating the hypotheses within the Integration stage, requiring proof of analytical sufficiency of the conclusions and assessment accuracy [13], coupled to adherence to accepted standards.

In this process model, the intelligence analysis algorithm may face many pitfalls. The first and most important appears to be the incomplete definition of the analyzed problem. This involves either a too broad or a too narrow view of the issue, ambiguity, emergence of individual biases, etc. Other issues are represented by the timeconsuming process and capacity of data management for complex projects analysis. From this perspective, a decisive value in elaborating standardized models for analysis is their capacity for transposition into automated processes. solving information retrieval from databases and processing it in support of analyst's consideration.

Hence, the principles proposed by O. Frățilă [14] can provide a mitigation framework:

- non-discrimination in the use of sources or analytical methods, completed with systematic exploitation of and corroboration with information from open sources.
- the use of analytical tools in support, and not as a replacement of the analytical efforts.
- employment of evidence diagnosis tests.
- use collaboration as a routine, not as an exception; recognizing biases, challenging individual assumptions, and

continuous learning is part of the team effort.

Appropriate application of the principles of critical and creative thinking within the individual parts of the analytical process also has an impact on the result. A properly set up intelligence analysis process with appropriate tools within its individual steps is likely to reduce the negative impact of the aforementioned factors and will have a positive impact on the output intelligence product. [15]

However, it still must pass the validation step before dissemination. In this respect, the reliability of the key evidence is a cumbersome factor for the Intelligence product. The proposed model includes a thorough evaluation of information and sources in support of hypothesis testing, thus making the link to the sensor and the effectiveness of single source analytical process.

4. Particularities of HUMINT analytical process

4.1. Single-source analysis. HUMINT analytical functions

The reports resulted from the single-source collection are submitted to single-source analytical elements, for primary processing. The single-source analysis is important from the perspective of information evaluation in a specialized environment, with specific expertise in addressing sensors' capacity, collection methods particularities, and sources' characteristics.

The result of the single-source analysis is further disseminated to all-source analytical elements for corroboration with information from other sources, contributing to final Intelligence products.

HUMINT, as an Intelligence collection discipline, is also responsible for conducting/ performing analysis within its information processing cycle. A model of analysis staging in HUMINT is offered by the US publication ATP 2-33.4 (fig. 5), which accounts for information assessment

responsibilities at all levels in the HUMINT organization.



Figure 5: The US model for HUMINT single-source information analysis Source: HQ, Department of the Army, ATP 2-33.4, Intelligence Analysis, January 2020, fig. 1-3.

The key tasks of the HUMINT analytical process are to provide, at various levels of reference [16]:

analytical support to the operational a. planning process and mission execution (contribution to Joint Intelligence Preparation the Operational of Environment, Intel/ HUMINT estimates, OPLAN. the targeting process, threat assessments);

b. **support to IRM & CM** (tailoring SIRs to match HUMINT collection capabilities, development of tasking and RFIs for HUMINT collection assets);

c. **operational analysis and assessment** (determine how to meet requirements by using the best suited HUMINT assets and evaluates the effectiveness of the collection efforts);

d. **support to HUMINT sources management** (from screening/ talent spotting to source assessments in terms of reliability and responsiveness to collection requirements);

e. **HUMINT single-source discipline analysis and production:** evaluation of the information provided by all HUMINT sources at a given echelon and corroboration with data received from other fellow resources - national level HUMINT platforms, Locally Employed Personnel screening cell, CI elements, Biometrics databases, exploitation assets – or open sources to determine interrelationships, trends, and contextual meaning; perform the technical review and quality control of the reports [17].

4.2. The HUMINT analytical process

To answer the intelligence requirements, HUMINT analysts conduct analysis of raw and fused data on a large range of collection topics, supporting (not exclusively) threat awareness, force protection, indications and warnings, mission planning, target development, damage assessment, effectiveness, measurement of or counterterrorism in the Area of Intelligence Interest. Given the particular importance of the human factor for HUMINT collection. HUMINT analysts assist in the identification and characterization of the human aspects of operations and their impact on friendly and enemy operations. Associated to the operational focus, the HUMINT specialists involved in these activities compile and analyze data about the local populations (e.g. ethnic, religious, political, social, cultural, and other aspects)

in the theatre of operation. Additionally, they model, simulate, and assess long-term trends that could impact the supported unit's mission [18].

The analysis does not reiterate facts but augments their informational value. While defining the problem based on the intelligence requirements and the contextual framework (specific to the level of information and the access mapping of the human sources), the HUMINT analyst formulates hypotheses based on available data, assesses the situation, and explains what the data means in logical terms. At this level, the hypotheses are answers to basic questions (essential elements of information) rather than producing a complete understanding of critical issues, as expected at the level of all-sources analysis. In many cases, the analytics technology and the changing nature of the threats have faded the classical distinction between single-source and all-sources analysis. Analysts at all levels have direct access to central Intelligence databases and open sources, and the limits in assessment are set at times by the collection focus. RAND experts have observed that many "allsource" analyses products are often "singlesource" products, where the analysts have striven to put that new information in context [19].

In this respect, the model presented in chapter 2.2 is seamlessly applicable, with certain limitations generated by the specific requests, the pool of corroboration resources, and potential for acquiring additional information needed to test the hypotheses. By difference, the all-sources analyst will always have access to a broader spectrum of concurrent fresh data on a specific topic.

As outlined in F.M.2-22.3, there are two basic reflection processes used by analysts to study problems and reach conclusions:

• **Induction** - the process of formulating hypotheses based on observation or other evidence, a process of discovery enabling the analyst to establish a relationship between events under observation or study. Induction, or **plausible reasoning**, normally precedes deduction and is the type of reasoning analysts are required to perform most frequently.

• **Deduction** - the process of reasoning from general rules to individual cases. The analyst must draw out, or analyze, the premises to form a conclusion. Deductive reasoning is sometimes referred to as **demonstrative reasoning** because it is used to demonstrate the truth or validity of a conclusion based on certain premises [20].

Integration of the information elements leads to the determination of significant facts, further compared to other known facts, enabling deductions, and drawing patterns of intelligence, such as a sequence of events or the profile of an individual or human network.

In practice, integration follows on from analysis without a break, and the two steps must be seen in coherence and not strictly separated. They are also critically dependent on the human judgement, informed by subject-matter expertise, with an onward look to automation and technology support in the analytical process.

Further, the HUMINT products are expected to be complete, concise, timely, written in active voice, unambiguous, precise, and sanitized, carrying a primary assessment of information veracity and source credibility. It gives a certain degree of uncertainty, making the single-source reporting less conclusive in answering intelligence requirements. However, in access/ insight, HUMINT terms of preserves its often-exclusive access to the adversary intentions, as a prerequisite for the predictive analysis.

4.3. HUMINT contribution to the competing hypothesis analytical model

As suggested by the proposed analytical model, there is a standing relation between all-sources analyst and partners from direction, collection, and dissemination aiming to enhance the analytical steps in the Intelligence cycle (figure 6), performance.



Figure 6: Venn diagram of Intelligence processing core functions and relations Source: P. Davies, K. Gustafson, I. Rigden, The intelligence cycle is dead, long live the intelligence cycle: Rethinking intelligence fundamentals for a new intelligence doctrine, 2013, figure 5, in <u>https://bura.brunel.ac.uk/bitstream/2438/11901/3/Fulltext.pdf</u>

To figure out the connection between HUMINT as collection discipline and the all-sources analysts, we consider the feedback (and additional collection requirements) and the reach back (seeking to clarify already acquired aspects), to assist the assessment process.

HUMINT raw reports generally include information filtered by the individual's perception and the biased assessment of the human source (even more diluted for information captured from sub-sources), doubled by the operator's subjective evaluation in the process of information preparation for reporting.

The HUMINT report is further assessed and completed with additional information and evaluation on the chain of command, with an important add from the analytical side – the HUMINT collator and, ultimately, the HUMINT analyst.

However, the single-source reporting often preserves gaps, ambiguities, and conflicts that need to be clarified.

In developing the competing hypotheses and evaluating the information, the allsources analyst needs to reach back to the collector for orienting additional data gathering and clarifying aspects that allow mining down into the validation and evaluation of the original sources to decide how to weight their credibility. And this is the best mark for an analysis-driven intelligence, as opposed to the collectioncentric model.

Related to HUMINT, the analytical model must preserve awareness that demands on current issues are hardly fulfilled in short time in case of poor coverage/ access; moreover, establishing the reliability of the sources may be another lengthy process, with due effects in reporting evaluation.

5. Conclusions

Intelligence analysis encounters huge opportunities. as well as tremendous challenges in the globalized world. Technology fosters analysis, but the emergence and democratization of global information networks have increased the effectiveness of manipulation and disinformation campaigns, requiring more sophisticated analytical processes and tools

[21], especially in the HUMINT analytical effort.

The role and place of analysis in the intelligence cycle are clearly defined, but service manuals and doctrines miss to promote a methodology and detailed procedure for conducting it, together with tools suitable for the individual phases of the analytical process – with few notable exceptions, consequences of the development of conflict management in the past two decades (asymmetric threat assessment, or human network analysis and targeting).

The structured competing hypotheses methodology proposed in the model will ensure a complete and, above all, correct understanding of the requirements of the intelligence customer, and their subsequent The detailed assessment. intelligence analytical process will be essentially the same for all levels of intelligence or classes of reference (single-source analysis), only the set of applicable methods and tools within the steps of the intelligence analysis process may be different (based on collection focus, level of reference or specialization).

It would require further investigation in determining the appropriate steps that lead to the goal of a certain type of analysis, as well as application tools, so that the final product at each level or single-source approach fulfill the essence of intelligence activities in support of the commander. As we have shown in this paper, single-source analysis (in our case, HUMINT) needs proper orientation and integration of its functions into the standard analytical model, within the channels of feedback and reach back.

Development of procedures and their modelling should also include analytics automation development (automated analysis tools, search engines, web-based reporting and portals, databases, pattern recognition, etc.), adapted to the evolution of the operational environment. However, tools must not limit analysis and are not meant to replace thorough knowledge on target culture.

From this perspective, training and education on analysis remains critically important and must be adapted to the current developments and trends, feeding the skills of the next generation of analysts, as well as their appetite to evade the Community to subject matter experts in academia or industry.

In NATO, education and training in Intelligence analysis is addressed by several relevant courses NATO at School Oberammergau (related to intelligence processing, critical thinking and structured analysis, etc. [22]) or human networkfocused (Human Network Analysis and Support to Targeting All Source Intelligence Analyst Course, at NATO HUMINT Centre of Excellence/ HCOE). Specific to HUMINT, HCOE delivers the NATO HUMINT Collator Course and envisages the production, certification and delivery of a course dedicated to HUMINT analysts, which promises holistic а approach of the incumbent tasks.

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