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Composite Indicators Used in Measuring Hybrid Threats

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Abstract. *The article aims to highlight the usefulness of composite indicators applications as an analytical tool in guiding national security policies related to multidimensional phenomena revealing its role in measuring hybrid threats - as part of global risks.*

The qualitative and quantitative research shows that the use of composite indicators in measuring hybrid threats at country level is a relatively new topic, that has enjoyed increased interest since 2021.

The originality lies in the way it is putted in evidence the link between the composite nature of hybrid threats, and the composite indicators in order the argue the role using this modern tool in the process of forecasting the risks with national impact, by using SWOT analysis.

To highlight the relevance of composite indicators in measuring hybrid threats to peace and security, we have chosen to compare the results of measurement made by Normandia Index. The outcomes demonstrate upward trend in hybrid threat values (cybercrime, economic crises, disinformation, energy insecurity and terrorism) at the UE-27 level (as one country), comparative to the world level situation, between 2019-2022.

We concluded that using composite indicators in measuring hybrid threats represents an analytical strategical level method that could play a role as an early warning engine to support policy makers and, also as a facilitator instrument of the planning process country level to avoid strategic surprises and prevent security risks.

Considering the geopolitical clashes of power poles and the unpredictable situation of the socio-economic environment, we have concluded that future steps of the research should be related with the dynamics of hybrid threats at the global level. An important contribution could be brought by the development of new systems for interpreting measurement by specialized software, and by the identification of appropriate calculation formulas to reduce misinterpretation due to the lack of real data provided.

Keywords: composite indicators, hybrid threats, global risks, Normandia Index, early warning, national security.

JEL CLASSIFICATION: C4, F52, H12, H56, H56

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Introduction

Today's hyperconnected universe makes the sources of global challenges take a multidimensional character.

To adequately prepare for the current era of "*simultaneous shocks*", the Global Risks Report 2023 underline that as being useful to take into consideration to the following principles: strengthen risk identification and prediction; recalibrate the current value of "*future*" risks; strengthen preparedness and reaction cooperation; and invest in multi-domain risk preparation. In the same time, it is appreciated that better risk identification and anticipation can be a key factor "*for strategic decision-making, agenda-setting and resilience measures*", aiding in this way to prioritize which areas should take priority in terms of data collection and monitoring. To better anticipate the emerging trends, it is considered that horizon scanning, and scenario planning can be achieved by examining qualitative as well as quantitative data sources. The Report also concluded that *"more sophisticated methods of analyzing interconnected risks (beyond linear relationships) can support the evaluation and prioritization of risk resources"* (World Economic Forum, 2023, p.69).

The European Union's Global Strategy underline that climate change, economic volatility, energy insecurity, hybrid threats, and terrorism, represents the main threats to the European Union (E.U.) the people and territory (E.U.b., E.U.G.S., 2016, p.9).

Today, perhaps more than ever, in order to respond to hybrid threats there is a need to form partnerships between different sectors (e.g. energy - transport - environment.). Thus, tackling complex and interrelated problems, whose determinants or solutions may lie beyond the direct control of a single sector, requires cross-sectoral action and reform at the global and therefore national level. The achievement of these reforms requires the provision of relevant data to decision-makers resulting from multi-data and multi-source analysis.

To anticipate developments and prepare for new opportunities and challenges, earlier and more effectively, European Union considers that "*composite indicators (or indices) can ... provide policy-makers with 'the big picture', crucial in shaping policy*" (E.U.d.-E.R.P.S., 2022, pp.2-3).

Given these warnings and policy recommendations, the objective of our analytical approach was to deepen studies related to the use of composite indicators in measuring hybrid threats, from the perspective of the role that this tool can play in the decision-making process related to national security policy.

The research was an exploratory and explanatory character, being was focused on the following question: *What are the pros and cons that can support the hypothesis that the of composite indicators is a relevant strategic tool that can be applied in the decision-making process in order to prepare an integrated national response to hybrid threats?*

Literature review

Conceptual delimitation on composite indicators

Indicators are used in several areas of environmental, social and economic statistics in order to present and synthesize information. In a number of cases, a combination of different types of indicators may be applied, starting with simple, single-variable indicators to the complex composite indicators which combine information from several different sources or domains into a single common measure. There is no internationally accepted definition of a statistical indicator; the term is applied in various fields and may have very different meanings.

To have a common understanding, in this article the term indicator is defined as being "a *summary measure related to a key issue or phenomenon derived from a series of observed facts or reported opinions, attitudes or expectations*" (UNECE, 2019, p.7). An indicator is not just a simply

basic statistical data, but it can be any summary measure of data - a percentage, mean, count etc., based on, or linked to a conceptual model or a context on which it provides information. Most commonly, indicators are represented by the data-information-knowledge pyramid, also called the knowledge management pyramid witch is presented in Figure 1.

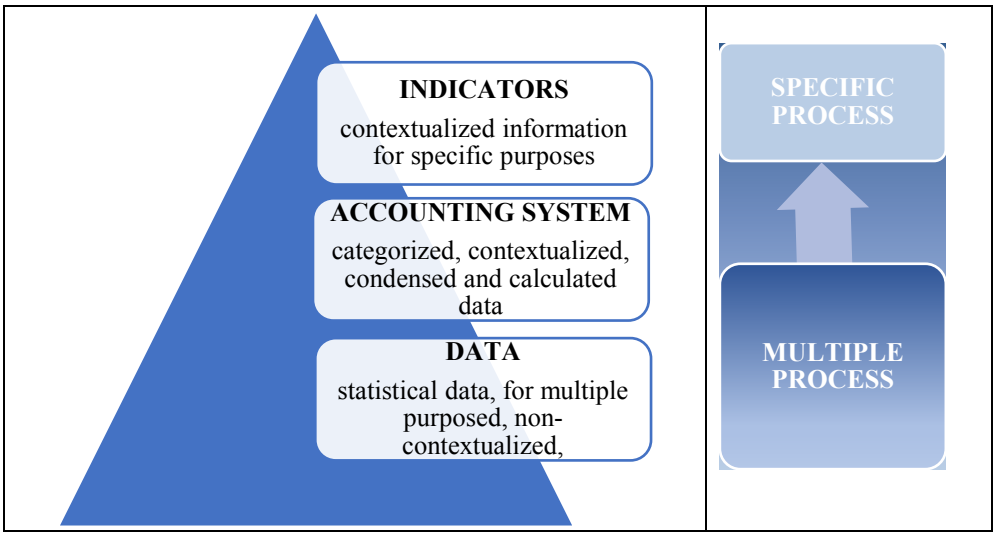


Figure 1. Data information knowledge pyramid

Source: Adapted from UNECE, 2019, p.8, apud. Eurostat, 2017, p.9.

Waas & Verbruggen (2014) defined an indicator as being the operational presentation of a given attribute (characteristic, quality, property) of a particular system, by qualitative or a quantitative variable (e.g. graphs, numbers, symbols, colors) (or function of variables), which also includes its value, referred to a reference value.

According to Schirnding (2002, pp.19-22) indicators can be specific or composite, which means in his view that they combine a wide variety of information on various (but related) phenomena in one single measure or index.

A composite indicator is composed when the individual indicators are joined into one index based on an underlying model. This is why, composite indicators are considered are very similar to computational or mathematical models. The composite indicator ought ideally to measure multidimensional concepts that can't be captured by a single indicator, e.g. knowledge-based society, industrialization, competitiveness, single market integration, sustainability, etc. (OECD, 2008, pp.13-14).

A composite indicator might include multiple dimensions, where the dimensions constitute separate domains or aspects of the phenomenon which is being measured. Where a composite indicator is covering more than one dimension, it is normally compiled in two steps, as illustrated in Figure 2.

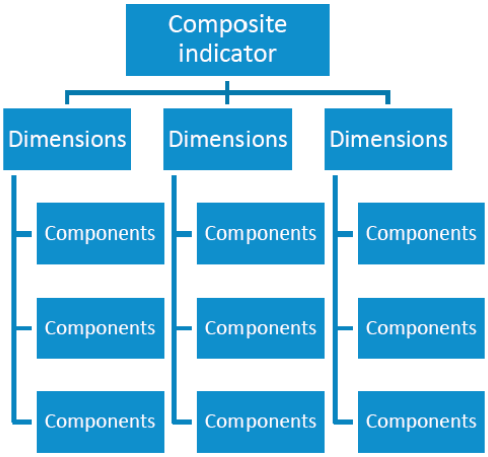


Figure 2. Dimension approach to constructing composite indicators

Source: UNECE, 2019, p. 13.

During the first stage, the component indicators under each dimension are weighted into a common indicator for that dimension. In the second stage, the indicator of the dimensions is combined into a composite indicator. (UNECE, 2019, p.12-13).

The composite indicator's role in decision making process

Schirnding (2002, pp.20-22) underline the role of indicators in the decision – making process. He appreciates that composite indices can be particularly useful for summarizing data and information for decision-makers and can be particularly valuable for making comparisons between countries. In the same time, he considered that, in practice, the construction of composite indicators is particularly challenging, requiring high levels of expertise in statistics and measurement to be able to weight or combine different variables. Furthermore, the selection of components as well as the way in which they are made they are weighted could be very subjective. In conclusion, in his view it may be difficult to verify or test composite indicators because they may not address specific measurable conditions. Some confusion may arise where the effects of individual components are variable and where relevant trends in one underlying component appear to be masked by the other components. Moreover, such indices might not be easily comprehensible to the public, who could have the perception that their actions had no impact on the indicator.

Gallopin (1997) points out that indicators that are not acceptable by decision-makers are unlikely to influence decisions, this is why he considers that it is useful to be fostered the political acceptability at the appropriate level (international, national, local).

Within the context of risk analysis and adaptation of policies and/or measures at national and international level, benchmarking using composite indicators is a useful strategic level analytical method in the process of identifying general trends related to policies and measures adopted in order to signal specific problems and set priorities to be taken in the context (Hîncu et.ad, 2010, p.530).

Also, indices may be used as early warning systems and are designed to provide policy makers with information on potential risks and developments in political, social, economic, security and environmental factors. Depending on what they consist of, indices may quantify the possibilities of an event happening in near/predictable future, thus acting as predictive tools (E.U.d.-E.R.P.S., 2022, p.2).

Composite nature of hybrid threats

In European Parliament acceptance, the term *"hybrid threat"* is considered to be a *"metaphor*" that speaks to the complexities and dilemmas of a changing world. It is frequently used interchangeably when referring to hybrid warfare to convey the interconnected nature of the challenges (e.g. migration, ethnic conflict, weak institutions, and terrorism), the multitude of players involved (e.g. regular and irregular forces, criminal groups) as well as the diversity of unconventional and conventional methods used (e.g. diplomatic, technological, military). The respond to our question research we have taken the E.U. definition presented in the guiding European Parliament paper *"Understanding hybrid threats*" which considered that *"hybrid threat is a phenomenon resulting from convergence and interconnection of different elements, which together form a more complex and multidimensional threat. Hybrid conflict and hybrid war are two specific categories whereby some hybrid tactics are used by a state to achieve its strategic ends*" (E.U.a, 2015, p.1). Among the most frequent example of hybrid threats the literature mention are: organized crime, terrorism, maritime dispute, covert operations and space.

Analysis of the challenges associated with hybrid threats has generated a comprehensive approach that combines all available players and tools: technology, military forces, political processes, diplomacy, economic development, and humanitarian aid (E.U.a, 2015, p.2).

A hybrid threat, in a military sense, involves a number of core concepts being considered a dynamic and diverse combination of irregular and regular forces and/or criminal elements, which are all unified to achieve mutually beneficial effects (Department of the Army, 2010, p.1-1). In an interview granted by LTG (Ret.) Ben Hodges (April 8, 2021) - who served in the US military, he defined *"hybrid warfar*" *as "the blending of conventional warfare, irregular warfare, and the use of other capabilities such as cyber, disinformation, money, and corruption in order to achieve a political outcome that is always backed up by the threat or the use of conventional weapon.*"

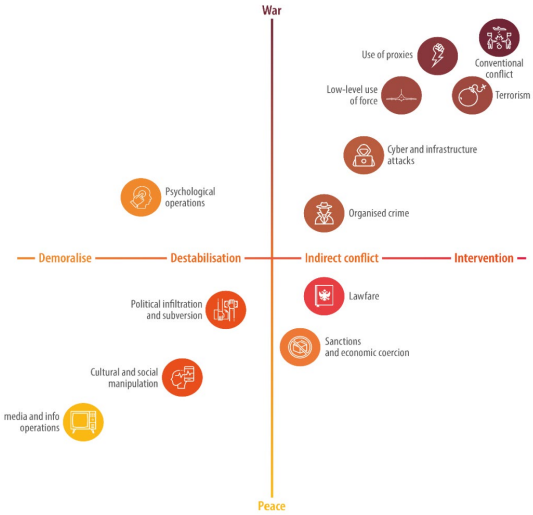


Figure 3. Means of Hybride Warfare

Sursa: Hodges, 2021

In the Figure 3 is an illustration of how hybrid threats can be represented on a time axis that demarcates peace from war. It also highlights the nature of hybrid threats as "*multi-faceted, comprising a combination of factors*" (Hodges, 2021).

Monov and Karev (2018, p.125) concluded that "*all new threats are compound and hybrid in character*". In their opinion, just serious assessment could help countries to be resilient in face

of a hybrid threat. This process should take into consideration, at least resource dependency, the demographic and economic situation, as well as the military and the law enforcement capabilities. Related to the decision making process to counter hybrid threats they considered necessary to simplify the process as well the data, proposing in this sense a chart of the process of assessment presented in the Figure 4 (Monov and Karev, 2018, pp.119-122).

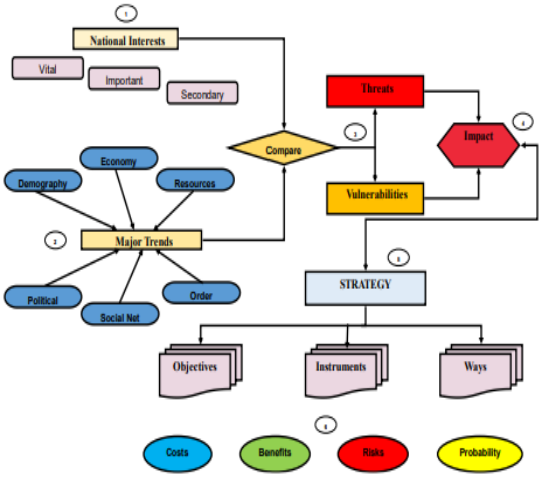


Figure 4. Process of assessment

Source: Monov & Karev, 2018, p.122.

The Global Risks Report 2023 highlights the interconnectedness of current global risks.

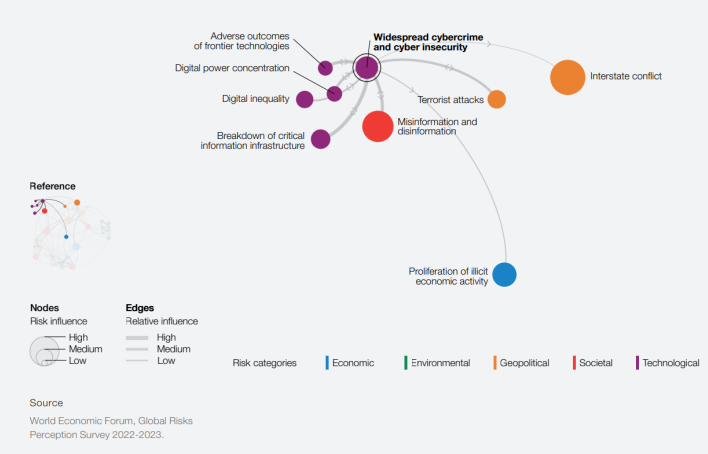


Figure 5. Map of global risk interconnections: cyber insecurity

Source: World Economic Forum, 2023, p.43.

In terms of hybrid threats, the report's findings highlight the technological, economical, social and geopolitical links of cyber insecurity - Figure 5, which is considered to be one of the top 10 most serious global risks in the next decade (World Economic Forum, 2023, pp.42-43).

Composite indicators used for measuring peace and security hybrid threats

The Institute for Economics and Peace (I.E.P.) ranks 163 territories and independent states in terms of their level of peacefulness. Annually I.E.P. elaborate the Global Peace Index (G.P.I.) – a report which presents ” *the most comprehensive data-driven analysis to-date on trends in peace, its economic value, and how to develop peaceful societies*”. The annual report uses 23 quantitative

and qualitative indicators and measures the degree of peace in the following areas: "*the level of societal Safety and Security; the extent of Ongoing Domestic and International Conflict; and the degree of Militarisation*." (I.E.P, 2022, p.2). G.P.I. The GPI is a composite index of 23 indicators which are combined and weighted into one overall score.

To respond to the geopolitical and strategical needs of the European Union, European Parliament, in cooperation with the Institute for Economics and Peace (I.E.P.), has been developed the "*Normandy Index*" (N.I.). This is considered to be an useful tool for E.U. policy-makers to measure the world's most at-risk countries in line with the EU Global Strategy (E.U.e.– E.P.R.S., 2022, p.24). The *EU Global Strategy* (U.E.b.- E.U.G.S.- 2016) identifies 11 threats as the main current challenges to peace and security: disinformation, economic crises, energy security, fragile states, hybrid threats, cybersecurity, climate change, terrorism, trans-border crime, violent conflicts and weapons of mass destruction (W.M.D.s). The N.I. takes 9 out of 11 of these threats as drivers and attributes them an equal weight in the total result of 137 U.N. (E.U.-27 is taken as one). Normandy Index main objectives are: to assess the state of conflict as well as the potential for conflict in any given country, taking into account the current state and the potential future state; to provide a tool to measure and monitor trends over time; to provide a mechanism in order to link the resulting threats to a classification of "*conflict status and risk*" which can be quantified and applied for policy-making purposes (E.U.d.- E.P.R.S., 2022, p.74).

Normandy Index 2022 considers that *"given the combined nature of hybrid threats, it is not possible to capture the risk posed to a country in any one measure*" (E.U.d., E.P.R.S., 2022, p.76). As arguments it is considered that hybrid threats bring together unconventional and conventional, non-military and military activities that can be used in a coordinated manner by state and non-state actors to achieve specific political and security objectives. These could vary from the undermining public confidence in government institutions and widening social divisions, to cyber-attacks on the critical information systems, to the disruption of critical services (such as financial services or energy supply).

Methodology

The documentation process consisted of a systematic review of existing literature. To this end, we used a qualitative analysis, evaluation, and interpretation of the results of the most recent research related to the topic of the article.

The key phrases on which we structured the search process were: "*composite indicators*", "*hybrid threats*", and "*measuring hybrid threats*".

In a first step, the research process included a bibliometric search conducted on 08th to10th March 2023, in the Springer database (https://link.springer.com) structured around three search themes, presented hereby in the Table 1-3:

Table 1. Comparing country performance using composite indicators

2019-2020 4.799 documents published				**2021-2022 12.930 documents published**			
Discipline				**Subdiscipline**			
2019-2020		**2021-2022**		**2019-2020**		**2021-2022**	
Medicine and Public Health	589	Engineering	1.930	Public Health	367	Artificial intelligence	1.184
Business and Management	555	Computer science	1.319	Quality and Life Research	261	Sustainable development	811

2019-2020 4.799 documents published				2021-2022 12.930 documents published			
Discipline				**Subdiscipline**			
2019-2020		**2021-2022**		**2019-2020**		**2021-2022**	
Engineering	428	Medicine and Public Health	1.294	Sustainable Development	240	Computational intelligence	758
Social Science	397	Business and Management	1.144	Business and Management, general	255	Environment, general	630
Economics	388	Environment	1.072	Sociology, general	209	Business and Management	533

Source: Authors' own research.

Table 2. Measurement the hybrid threats by composite indicators

2019-2020 29 documents published				2021-2022 71 documents published			
Discipline				**Subdiscipline**			
2019-2020		**2021-2022**		**2019-2020**		**2021-2022**	
Business and Management	9	Engineering	20	Marketing	4	Artificial Intelligence	12
Social Sciences	6	Business and Management	7	Business Strategy/Leadership	3	Computational Intelligence	10
Computer Science	2	Computer Science	7	Information Systems and Communication Services	3	Data Mining and Knowledge	5
Education	2	Political Science and International Relations	5	Automotive Engineering	2	Energy Policy, Economics and Management	5
Engineering	2	Energy	4	Human Resources Management	2	Materials Science, general	5

Source: Authors' own research.

Table 3. Composite indicators used in measuring the hybrid threats countries level

2019-2020 26 documents published				2021-2022 63 documents published			
Discipline				**Subdiscipline**			
2019-2020		**2021-2022**		**2019-2020**		**2021-2022**	
Business and management	7	Engineering	18	Business and Strategy/Leadership	3	Artificial Intelligence	12
Social Science	6	Computer Science	6	Information Systems and Communication Service	3	Computational Intelligence	10

Political Science and International Relations	3	Business and Management	4	Marketing	3	Data Mining and Knowledge Discovery	5
Computer Science	2	Energy	4	Automotive Engineering	2	Energy Policy, Economics, and management	5
Education	2	Materials Science	4	Human Resource Management	2	Cyber-physical systems	4

Source: Authors' own research.

This first step of our documentations has putted in evidence following conclusions: in the period 2021-2022, compared to 2019-2020, the number of papers published on these topics increased significantly; most of the topics related to these themes have been addressed in books; the level of interest in the disciplines and sub-disciplines related to each of these themes varies from period to period; artificial intelligence, management, engineering and energy policy are the main areas currently receiving increased academic attention in terms of measuring hybrid threats using composite indicators; the use of composite indicators in measuring state performance is a relatively new topic of interest in scientific and academic circles mainly from 2021 onwards.

The second stage of the documentation process consisted in a qualitative analysis, during which we evaluation and interpretation of the results of the most recent work published by the E.U., international organizations as well as the academic research community. Alongside to this analytical process, we have deepened the arguments underlying the use of composite indicators in the analysis of the countries' performance, as well as the relevance of the results obtained by using this tool, from the perspective of the research objectives. At this aim, at this stage we have used the study of databases (more than 12 websites), as well as the results of relevant analyses related to hybrid threats, published in the period 2019-2023, by governmental and non-governmental organizations, academic institutions, think tanks, namely: the European Union (E.U.) - Normandy Index, INFORM, Center for European Policy Analysis (C.E.P.A.); United Nations (U.N.) - International Telecommunication Union - I.T.U.; International Monetary Fund (I.M.F.), World Bank (W.B.), Energy Data Science (Enerdata), Institute for Economics and Peace (I.E.P.), Swedish research institute "Varieties of Democracy" (V-Dem), as well as the online scientific publication "Our World in Data" (O.W.D.).

This second step of our research revealed the followings main remarks: the analysis of country performance using composite indicators is a topic developed mainly at the level of international organizations and the E.U.; at present, composite indicators comparing country performance are becoming increasingly recognized as a useful tool in: policy analysis, public communication, and simple country comparison; the most relevant handbooks addressing the theoretical aspects of using indicators as a tool for measuring country performance have been developed by the Organization for Economic Co-operation and Development (2008) and the United Nations Economic Commission for Europe (2019).

The software program used to process the statistical data was Excel.

Results and discussions

As an concrete argument, in order to highlight the relevance of composite indicators as an early warning tool which can be used at the national level in the process of elaborating countermeasures to the hybrid threats we have chosen *Normandia Index* – presented in Table 4.

Table 4. Evolution of hybrid threats at EU-27, between 2019-2022

Global hybrid threats	Cybersecurity	Disinformation	Economic Crises	Energy Insecurity	Terrorism
2019	4.63	4.32	6.45	8.94	6.07
2020	6.51	6.54	7.7	6.6	8.03
2021	8.5	6.6	7.33	6.58	8.17
2022	8.5	6.62	7.13	6.58	8.50

Source: Authors' own research in the Normandy Index https://www.europarl.europa.eu/thinktank/infographics/peaceandsecurity/index.html#/map

The index is calculated in such a way that a higher score indicates a better security situation. Thus, an 'reverse' standardization has been applied to the indicators which links a higher value to a higher threat. For each country, the value of every indicator ranges from 0 (under a defined minimum) to 1 (over a defined maximum) (E.U.c.-E.P.R.S., 2021, p.20). The measurements for each indicator that is included in hybrid threats reveal the increasing dynamics of risks, for the EU-27 compared to the world, over the period 2019-2022.

In the final stage of the analytical approach to validate the research hypothesis, we conducted a SWOT analysis (Table 5**)** to summarize the pros and cons of using composite indicators in the analysis of hybrid threats to states.

Table 5. Composite indicators in measuring the level of hybrid threats – SWOT analysis

STRENGTHS	WEAKNESS
- Provides summarised information on the evolution over time of the situation at national, regional and global level in the affected areas or sub-areas; - Provides measurements based on methodological and statistical expertise; - It uses tools that make use of a large number of indicators, as well as existing databases that can be accessed free of charge online (W.B., Normandy Index, Enerdata, INFORM, I.M.F., I.T.U., I.E.P., E-DEM, O.W.D., etc.); - Facilitates the interpretation of the results on the effectiveness of annual measures related to hybrid threat prevention and management policies at global and national level; - Allows information to be decoded visually, from different angles, in a short time, using specific techniques for graphical representation of measurement results (e.g. "spider" diagram).	- The inability to provide relevant results in the absence of real data, provided in an optimal time, means that the results of measurements using composite indicators are, in certain situations, highly relative; - Syndromes in obtaining data due to the unpredictable dynamics of events, as well as the transversal and cross-sectoral nature of hybrid threats; - Lack of human and material resources to implement analysis based on composite indicators or to interpret the results of measurements based on composite indicators.
OPORTUNITIES	**THREATS**
- Contributes to the orienting national security policies, facilitating the avoidance of strategic surprise; - Offers the possibility to improve the results of analyses carried out in the framework of early	- Misleading decision-makers if composite indicators are poorly constructed or the result is misinterpreted, thus favoring the development of

warning systems, which can contribute to the setting of objectives related to strategic planning at national level, including in the framework of an integrated national risk management and crisis prevention system; - Facilitates the increase of expertise using new IT tools and data sources.	overly simplistic analytical or policy conclusions. - Allows manipulation of results in case of missing data through intentionally wrong formulas.

Source: Authors' own research.

The analysis findings reveal that the use of composite indicators in measuring the level of hybrid threats on the states is a relevant analytical method that can play an important role as an early warning tool related to the national security policies. Thus, in our opinion, this conclusion validates the hypothesis of our research.

The results of our research lead us to the following conclusions: hybrid threats are composite in nature; composite indicators bring together multidimensional processes into simplified and stylized concepts providing a 'synthesized' view of current conditions and trends that can be applied in decision-making processes; the use of composite indicators in the strategic level analytical process can be considered as an early warning tool facilitating the process of monitoring the impact of certain security policies and on the other hand support forecasting exercises; the application of composite indicators in security threat analysis can support the process of developing policies to prevent or mitigate risks; within the context of risk analysis and adaptation of policies and/or measures at national and international level, comparative assessment with the help of compounded indicators can be useful in the process of identifying general trends related to policies and measures adopted in order to signal some specific problems and set priorities to be taken in the context.

The final findings of our analysis indicate that composite indicators are a strategic-level analytical tool that can play an early warning role for states in terms of security policies, thus contributing to their orientation as well as to the establishment of strategic planning objectives at an integrated level. Taking these elements into account we consider that the research hypothesis is validated, in other words, compositional indicators can be considered a relevant tool that can be used in the strategic decision-making process to prepare a country's integrated response to hybrid threats.

Conclusion

By putting in evidence the link between the composite nature of hybrid threats, and the composite indicators the article the argue the role using this modern tool in the process of forecasting the risks with national security impact.

The main contributions of the paper rest in the continuing the research related to the field of using the composite indicators as a security policies decision-making useful tool also in benchmarking a country performance.

The findings of our research highlight the tendency of hybridity to extend to all global risks, which is why we believe that anticipation of potential interconnections plays a very important role in guiding preparedness measures to minimize the amplitude and their intended aims, prior they occur. The current evolution of geopolitical confrontations between the poles of power, as well as the vulnerability of the socio-economic environment aggravated by the debate on the application of existing international law in cyberspace, the war in Ukraine and the maritime disputes in the

South China Sea, could be a few of main factors expanding the scope of hybrid threats. Among the future hybrid threats we believe could be numbered: covert operations, resource depletion, maritime disputes, limitations on the use of orbital space.

From this perspective, we believe that further research related to the topic of the article should be harmonized with global threat developments specific to the VUCA world. In connection with this dynamic, we believe that particular attention should be paid to improving systems for interpreting the results of measurements obtained from the application of compositional indicators using specialized software. At the same time, we consider it useful to deepen the research to find suitable calculation formulas that reduce interpretation errors caused by the lack of real data, provided in optimal time.

The issue of how composite indicators are or can become analytical tools in the process of policy development related to the analysis of hybrid threats at the national level is a relatively new topic, which has not received much attention from the academic community so far. This makes the research limited in terms of comparison with other works related directly or indirectly to the field.

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