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DYNAMIC MATRIX METHOD BASED ON INFORMATION THEORY IN ANALYSIS AND ASSESSMENT IN COUNTER-TERRORISM

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Wherever and whenever the analysts face a new phenomenon – in the fields of economics, industry, agriculture, politics, national security or others – some questions emerge immediately. What generated the incumbent phenomenon, how it has emerged, what kind of origins it has, what could be the consequences and what and how shall we do to minimize the possible negative consequences or to neutralize them or in the best case, to make them positive for us. In order to answer these questions it is indispensable to understand the internal evolution of the phenomenon, the dynamics of the factors that affected it prior to the tangible for us emerging. Once we have already gathered a set of data, the next recurrent problem is how to process them into information and how to set up the priority line amongst the factors, which influenced the evolution of the phenomenon drawing multiple possible outcomes and how to select the most probable one of them leading to the current status of the phenomenon in question. The roots of the problem to answer to these questions can be defined as:

- Difficulties to determine the criteria for analysis;
- The big variety of data;
- Limited data-processing capacities;
- Mostly static approach to data, as a consequence of reduced perception of dynamism;
- HR-based problems.

The consequence of these deficiencies are:

- Slow decision-making process. With certain sarcasm, we can remark that since the humankind exists any decision-making process was fast enough for the decision-makers.
- Often uncertain, insufficient conclusions of analysis and assessment papers.

The uncertainty caused by the emerging phenomenon generates the difficulties of selecting the criteria for the analysis. It is easy to understand that the only point at this stage that can make the job of analysts smoother is to focus on the possible impacts caused or possible to-be-caused by the phenomenon. The priorities of sorting the criteria can be set as vital, critical, significant, important, secondary and collateral.

The same system as above should be applied when considering the data. At this stage each of the six ranks must have at least a three-grade division: direct, close, peripheral according to the influence the data exercise on the priorities.

The limited capacities can be solved by increasing the hardware and software support up to a certain level but the old methods like root case analysis, SWAT, SWAT-C, comparative analysis, mathematic game theory have no remedy they should be replaced by a new analytic method. The problem with these old methods is that all these depart from the situation at the given moment. Thus, the result of these analyses rather refers to the status-quo, it is partially retrospective and very-very little prospective. This prospective capacity is more than limited due to the limited set of factors taken into consideration when analysing.

It is obvious that any short-, mid- and long-term action plan requires the analysis of the appropriate depth tailored to and upon the goals of the action. The depth always depends on the multi-dimensional range – including the timeline – of the data collected for analysis and to-be-converted into information. Therefore, the increase of data-processing capacities is vital for the enhanced or upgraded analytical work. Dynamism is the key word to increase the range of view of the analysis and to improve its quality and versatility. What dynamism means in this case? Since the classic and medieval physicists it has been clear that everything in the world is in permanent change i.e. its status is dynamic. One moment differs from the other on the time line subsequently the objects, processes, actions are also in permanent motion so their characteristics also change as time passes on. To understand and to make a close probability calculation of the possible ways of development of everything in motion we have to consider the factors composed of data transformed into information influencing the subjects of our research. There is no other chance to reduce the time gap between the events and phenomena on the time line and the close probability assessment necessary for the further decisions to-be-taken in the given case, than the analysis based on the influencing factors and following the changes caused by them. This analysis is an endless process whose length depends only on the sequence of time necessary for the decision makers.

Problems in the field of human resources also have a negative effect on developing the analysis and assessment capacities. This disadvantaged situation can get even worse once the educational system is strongly linked to the old-fashioned Byzantine and Prussian didactic methods of education. By changing the methods of education, the results of instruction improve immediately. The introduction of the new analytical solution requires an urgent modernization on the education at all its levels. The key point is to develop the capacity and capability of the new generation of analysts to consider problems from different – permanently changing – points of view.

To implement the new method we face two very complicated important *tasks.* There is never enough time so these tasks must be carried out parallel. For the first one we can use the old databases, complemented, modified and adapted to fit the new criteria of the new method.

The second one needs new resources beside of a new mentality. It will combine the efforts of scientists and practitioners of many fields.

The first task departs from the supposition that the basis for any analysis is the mutual influence of information as a basic component of systematized data having certain effect on other similar components. One of the primordial tasks is to select or to set up and develop the widest, deepest database. It shall be very comprehensive and shall extend to the widest possible range of other field databases.

The second task parallel to the first one is to solve the problem of data-processing. To process this enormous pile of data we have to find new ways for mathematic approaches including new algorithms. Another very important point is that without Artificial Intelligence (AI) it is almost impossible to deal with this task in its complexity.

The expected results of introducing and using the new method are the following:

– shortening the reaction time to changing conditions;
– increasing the credibility of analytic conclusions;
– increasing the efficiency of decision-making;
– increasing the applicability of decisions;
– save and spare human, material and environmental resources.

Now it is time to clarify some basic notions. *What does information mean* for us in this sense? It is single or combined data plus elements to link them to other possible data. With a metaphor from the house-building field, information is a brick with cement to stick to other bricks. The information without interaction with other information perhaps is useless or has very little effect. It acquires importance only in the context of other information that we call "transformation chain of information" like this: *information – knowledge – capability – action.*

In this chain *knowledge* means the cloud or agglomeration containing "n" (unknown) amount of information related to each other by strong or weak linking ties, without physical parameters. Information can be sorted by their time of formation, creation or perception. It is also a flow system! One of the speakers of the conference held at the National University of Public Service, Budapest, Hungary, on March 3-4, 2020 Mr. Brian Rivera in his lecture called flow system *"OODA-loop"* (Observation Orientation Decision Action). We call it "information spiral".

Capability for us means the possible targeted use of agglomerations of knowledge. Identical agglomerations or groups of agglomerations can be applicable for different capabilities. The experiences and observations of the practical use of any capability have information value (a blow-back?) influencing on the knowledge securing its dynamism.

It is important to mention that information is not a simple phenomenon. It has some characteristics, which help us to carry out analyses and assessments. It is also important to have in mind that the characteristics of information are not permanent, they change in interaction with other information as the time passes.

Information characters are:
- positive A: brand new;
- positive B: confirming previous information;
- neutral: the possible use is unknown in the given moment;
- negative: denying previous information;

Information value status:
- positive: useful;
- neutral: uncertain about possible usefulness;
- negative: useless;

Timeframes of the analysis are always the given moment or a reasonably short or longer interval prior to the given moment. Subsequently, the *timeframe of the prospective assessment* refers to moments in the future when the consequent events, phenomena or moments have a certain grade of probability to happen. The reason and the validity of this position are that permanent dynamic changes are going on in the same time at different levels. Therefore the changes of data can alter the information built on them and subsequently the change of information will modify the knowledge and the capabilities as well.

*The magnitude and scope of the changes to be considere*d depend on the importance of the information from the point of view and actions of the person(s) or institution(s) carrying out an analysis and assessment of the mutual impacts of data, information, knowledge and capabilities in the inter-agglomeration space.

THE MATHEMATIC BACKGROUND

The relations among data, information, knowledge, capabilities and actions could be mathematically described by a system of equation of unbounded functions containing unlimited or unknown numbers of functions. Information is also functions. We shall notice that the

Fourrier series based on harmonic changes are not able to describe the disharmonic but not ad-hoc changes in the inter-agglomeration space.

In another way, the complex of agglomeration of knowledge and capability can be imagined as an amorphous part i.e. a dynamic matrix in the virtual space where the interrelations between different elements have a three-dimensional amorphous structure. The reference axis is the time line along which one analyses and assesses the data, information, knowledge, capabilities, and makes a decision to act.

The analysis is made at a certain point on the reference axis, therefore the validity field of the information value status is around this point. The range of the validity field is determined by the dynamism of the factors influencing the data composing the information that is being analysis at the given moment. If the data change the end point of the validity field, closing the validity period on the timeline will change immediately. With this change the end point of the previous validity field will transform into the starting point of the next validity field.

The field of gathering the data and information for the analysis and assessment is part of the dynamic matrix. One can imagine it like two funnels or cones turned to each other with their smallest diameter. Where they touch each other is the point of analysis and assessment. The largest diameter of the first cone can be infinite depending on the range of data and information we use for carrying out the analysis and assessment, and the largest diameter of the second cone can also be infinite depending on how far we want to go forward with our deductions as the result of the assessment. It is clear that the closer we approach the smallest diameter the higher and higher is the accuracy of the information/factors leading to the features of the information in question at the given point of analysis due to the closer links between the factors/information. Thus we can set up the picture of the 'prehistory' of the formation of the information we analyse.

Subsequently, as we leave behind the point of analysis the accuracy of the assessment of the possible consequences in the second cone will be smaller and smaller due to the growing variety of plausible new factors/information capable to impact the information creating possible alternative consequences.

WHAT IS NEXT?

The next phase of the research aimed at the practical implementation of the theory above is to set up its mathematic model including the conversion of data and information into algorithms ready to be processed digitally by the AI. The research also includes the way of handling the big data, to filter the enormous amount of data and information in order to receive the targeted necessary set of data/information.

WHAT IS THIS METHOD APPLICABLE FOR?

The practical use of the dynamic matrix method based on information theory is not limited to counter-terrorism, it is applicable in economics, finances, other political fields, defence, and social planning as well. The importance of counter-terrorism as one of the primary fields of application is clear: after the military losses that terrorism had during the past couple of years it is logical that the terrorist organizations undertake the necessary changes – change of paradigm and diversification of activities – to achieve their strategic goals in another possible ways. No further explanation is needed why a new, faster, and accurate method is so important in analysis and assessment.