NETWORK-RESEARCH BASED DYNAMIC METHOD IN CRIME PREVENTION AND INVESTIGATION

Zoltán György Bács, PhD[1]
Ludovika University of Public Service Budapest, Hungary

PURPOSE

The purpose of the present study is to introduce the basic concept of the new method, to explain the interconnection between formation of new information based upon already known information, the time-flow and the formation of information networks and the dynamic link between the changing values of information on the subsequent progress of the investigation. This paper is also aimed to point out the urgent need to change the traditional concept of crimes as social and societal phenomenon. The suggested new method gives a chance to consider the crimes in a much wider context, including some psychological aspects of delinquency in general terms and in specific types of crimes.

The method in matter also demonstrates the advantages of the new approach. Among them, the quicker decision-taking and the subsequent higher operability are the most important ones.

DESIGN/METHODS

The method of research presented in this study is deductive and comparative analysis. The deductions leading to setting up the new theory of information and the new theory of dynamic networks and its possible fields of application started four years ago during a regular coffee break. The most important obstacle of carrying out a traditional academic research was that neither the Hungarian nor the international scientific literature had publications related to this new approach to the information. Another, not less significant difficulty I had to overcome was that although there are different practices of using dynamic matrix-based solutions, they are mostly just to observe the current or at least short-term tendencies in economics and finances. I discussed this topic with one of the internationally acknowledged experts in the field of theory of networks, Albert-László Barabási, who confirmed they researched the dynamic matrix neither from point of view of law-enforcement nor from other perspectives. They usually research networks properties in the daily life, like phone or postal networks, etc. … (Barabási, 2003).

Other publications dealt with the phenomenon and use of networks in the field of public service (Auer Ádám & Joó Tamás, 2019), even though the most meticulous search for similar publications in the field of law-enforcement or counter-terrorism did not give any result. I had no other chance than going forward alone.

Beside the theoretical explanations, the study contains several fictitious cases to depict the theory in situations close to real circumstances.

1 bacszgyorgy@gmail.com

APPROACH

Every single crime is a result of a process influenced by many different factors and processes. The factors are also results of processes, which led to the factor that in one way or another played certain role in the further development of the process, which culminated in the crime in matter.

Some of the factors influenced the circumstances of the crime, some other factors had connections directly to the perpetrators. Among the latter, there might have been those which triggered the personal features of the perpetrator(s) encouraging or discouraging them to perpetrate the crime. In the human sphere, even in the criminal world, the factors usually reach any person in form of information. What refers to the factors influencing the circumstances, the changes reach the persons involved in that activity in the form of information and provoke certain reactions. The reaction(s) contain information for other people with whom the first person is linked in one way or another. Is it a network? Yes, it is. Does the information spread over through the network? Yes, it does, no doubt!

All our professional life tightly linked to the phenomenon, we call information. Therefore, one of the key points was to find out what information is, and how the information appears, what kind of character the information has and what kind of factors may influence it? The next couple of questions appeared immediately: does the information have a life cycle, how can we determine the value of the information and its impact on the ongoing process (investigation)? The third level of question began when we try to find out the way how the information can link to other information. What should be common between different elements (information) to find and join each other and compose new information?

Once we have a more or less clear picture of the properties and mechanisms of information we must answer to the next question: what kind of limits might have the information network? Can this network have any geometrically describable form? Both questions have a negative answer. Neither the information network nor its geometry can be determined. The information forming networks cannot have timeframes, since nobody knows when information emerged first. The links between different elements of information network could be close or could be very remote. One of the examples is the so-called "Butterfly Theory", i. e. everything is linked to everything. What does it mean in practice? It means that any change in any element of the information network will have a consequence in other elements in one way or another. The chain reaction of consequences will spread all over the network provoking subsequent changes even among the remote elements.

FINDINGS

Types of Networks[2]

The statement above is valid in cases of open 'dynamic' networks. While the elements of the dynamic networks are exposed to changes and interact with other elements, they can be linked directly or indirectly in different ways and also can integrate new elements, the so-called 'static' networks cannot integrate new elements, their elements have permanent links and under no circumstances changes influence them. Neither can they change their value; the marks on its sides are always the same. The elements of the static networks never interact. For example, the dice is a static close network. It can have many different reference points as for example any of its sides, the geometric center of the cube, any of the angles, etc. …

2 This paper does not study the bi-dimensional and classic mathematic networks.

Another type of network is the Rubik's cube. Its elements, sides are exchangeable; they move according to certain patterns but no other elements can join the network. It has a concrete geometry and new elements can be attached by changing the basic geometry only. The Rubik's cube is a dynamic close network. Although the reference point of the Rubik's cube might be any of its elements the most practical reference point is the crossing point of main axis in the geometric center inside the cube. In spite of moving the elements according to certain patterns, the elements value, i.e. their color always remain the same.

The dynamic network has no geometry, has no geometric reference point, its elements may change their values and may have different influence on each other depending on other circumstances and the time of new information. The dynamic network grows with every new information since new information may extend the previously formed network integrating new 'sub-networks' through the new, recent information.

The Main Reference Point of the Dynamic Network

As the dynamic network does not have a traditional reference point like the geometric, mathematic, or trigonometric center, there must be something else. Yes, indeed, there is the most special reference point: the time! Maybe, the time is the most enigmatic thing in the world. It is not a phenomenon like light or sound, it cannot be perceived like altitude or depth, it has no beginning, has no form of appearance. Neither has it direction. It does not have any natural measurement. Due to the genius inventions of the human spirit we have mechanical, electro-mechanical, electronic and nuclear devices that help us to measure the periods of different length of time.

We have stated earlier that the dynamic network has no geometric form that is amorphous. Thus, the only way to orientate in the network is the use of anteriority of information forming the multi-dimensional network. Yes, the time may serve to orientate only but not to determine the consequent line or chain of information. The reason is the following: we perceive the new information input in a given moment that can be exactly determined. Nevertheless, between the moment of perception and the moment of the 'birth' of information there might be a significant difference in time. The birth of information always prevents the perception of the information.

Life Cycle of Information

Does the information have a life cycle? Yes, it has! The 'life' of the information starts when it appears of the combination of minimum two, or may be more, previous information. At this point previous information may become invalid because of being replaced by a new one. This new information is valid until a newer one replaces it. During the life cycle of information, its comparative status (Comparative Information Status, C.I.S.) and its impact (Information Value Impact, I.V.I.) play a significant role in analyzing and assessing the on-going process(es). The role and significance of the value and impact I shall explain later.

Retrospective and perspective - predictive view on information

All the information what we perceive at a given moment has already modified the direction (vector) and the impact of the flow of information in progress. At the given moment, when we perceive the information, it has already modified what has happened earlier, thus we see the result of the accumulated impact of all the previous information, the modified vector of the flow of information in progress.

Sometimes, it is not enough to relay on the already known information when analyzing any process because missing or yet unknown information may modify the vector of the process in question at another moment. Therefore, it is highly important to consider whether there were breaches in the information flow. The breaches mean that information, which has already modified the process in question earlier, remains unknown, thus we can only speculate what has been its effect on the process. Based on the information context we might have a chance to calculate or at least suppose what could have been the missing information and what kind of effect it had on the vector of the process in question. This retrospective analysis may have an important role in giving a predictive assessment, when a later information relevant to that unknown one mutually effect the further calculable alternative vectors of the process in question. The permanent phenomenon of interference of information of different periods, relevant in obvious or even hidden form to the process in question, consists the fundament of the method of retrospective-based analysis and dynamic predictive assessment to be used in crime prevention, investigation and counter-terrorism.

How can we imagine the analysis in progress? Is there a chance to visualize the approach to the point of analysis and to follow it in the direction of predictions? Of course, it is possible. 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 we analyze. 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 influence the information creating possible alternative consequences (Bács, 2020).

COMPARATIVE INFORMATION STATUS (C.I.S.) AND INFORMATION VALUE IMPACT (I.V.I.)

Comparative Information Status (C.I.S.)

To give an appropriate definition to the notion Comparative Information Status, we have to return to the question: what is the difference between data and information? If you search through different encyclopedia, you will find several different definitions. From our point of view, the most suitable definition is the following: data with some property that qualifies it as different from other data from the same category. (For example, data category is color, temperature, frequency, etc… Information is yellow color, high temperature, low frequency….)

It is also well known since very remote times that there is no useless information. The question is always the same: who will, when and what for use any information. Consequently, any information has a status expressing its novelty for those who are interested in the information. Starting from this, the status of information can be determined in comparison with other related information and may be received earlier. Therefore, information can have the following status:

- Factual New (FaN), if it contains unknown earlier real information that might be proven;
- Already known information (Kn);
- Information denying previous information (D);
- Calculable (Ca), if its probability based on other information is 50% at least;
- Supposed/Probable (SuP), if the probability of the information is less than 50%. (Bács, 2022)

The practical use of the classification system above is imminent when during any law-enforcement activity urgent need of assessment is required. Using this classification makes easier to sort information for further use, what is necessary for the selecting and planning not only the next measures, but also for setting up a draft of a longer operational plan. This classification indicates the status at a given moment, what can change when new information is available. For example, we have classified some information as SuP, but another information source confirms our information as trustworthy thus the information changes its status into FaN.

Mathematic Expression for Information Value

If we need to use a quick code system for operational purposes, I suggest the following:

- For factual new information (FaN) I^{+};
- For already known information (Kn) I^{0};
- For information denying previous information (D) I^{-};
- For calculable information (Ca) $I< 50\%$;
- For supposed/probable information $I> 50\%$.

These codes might be used during immediate analysis and assessment of the results of interrogations as well.

Information Value Impact (I.V.I.)

By determining the criteria of I.V.I. the most obvious way is to consider the possible consequences, the possible urgency of taking measures upon the (new) information. These criteria may be the following:

1) Vital importance;
2) Critical;
3) Significant;
4) Important;
5) Secondary;
6) Collateral.

What does it mean?

1. The information has vital importance if it contains information requesting immediate response due to its possible consequences radically changing the situation or even the outcome of the on-going operation or investigation. For example, we are in the process of apprehension of a supposedly unarmed person but on our way there our operational team receives information that the target person has concealed firearm or that we can face an armed group ready to resist and counteract us.

2. The information is critical if the new information radically contradicts or questions the previous decision (based on previous information). For example, the team is going to apprehend a person at his/her home but the external vigilance group informs us that the target person has left his/her home and is moving. This information radically changes the majority of conditions of apprehension.

3. Significant may be the information if it does not alter at the given moment the result of the on-going investigation or operation but it may influence the circumstances of implementation. It may happen when the operative team is going to arrest a person, but we have received information that he/she is ready to give himself/herself up voluntarily.

4. The important information does not influence the result of the on-going investigation or process but may change the conditions of implementation. For example, the person under investigation voluntarily delivers the evidences or expresses his/her will to make a comprehensive and detailed confession (the present criteria are also suitable for the classifications of evidences).

5. Secondary is the information we have acquired when investigating the target person's individual and financial conditions, his/her social network and other circumstances, which have no influence on carrying out the investigation. For example, the person in question liked riding a green Volkswagen Passat.

6. Collateral is the information which is not related to the given case and has no influence on the on-going investigation or process but may be reevaluated and linked to other information (case) or its preliminary classification as collateral and has to be modified or changed. For example, if the green Volkswagen Passat has been sold to a person involved in another crime.

This classification system and its criteria are not carved in stone or definite. There might be other sub-criteria or sub-divisions as well brought up by the changes in criminal investigation or in law enforcement in general. The essence is that all phenomena, all evidence, all actors and their circumstances have to be considered as elements of a wider network in permanent changes. Once we understand the dynamism of the network, we will be able to consider the possibly expectable changes within the network.

Application Opportunities: Crime Prevention and Law Enforcement, National Security and Counter-Terrorism

The information theory described above – as I have already mentioned – composes the fundament of the predictive analytical and assessment method based on the research of dynamic networks. To make the analytical and assessment method run, it is indispensable to register all the features of the object of research up to the smallest ones. The structure of registration (Field Information Base, FIB) must be a pyramidal one splitting up the details of every feature in several subgroups from the top to the bottom, giving more and more details. Another almost similar and parallel pyramid will contain the known details (information) of the given case (Case Information Base, CIB). Comparison of the CIB with the FIB will show the general features of the case, and the peculiar ones. It will show whether there are new, unknown before features. The comparison of the information bases will also show whether there have already been cases with almost identical or similar features. Up to this point, there are very few elements compared to the traditional law enforcement methodology. The only new features are probably the digitalized register of features of all the crimes and the computer-assisted comparison process. A new element is the integration of many other FIBs into the comparison process. The more fields are included, the higher the background of the given criminal case is. One of the most important fields to be processed in the FIB is psychology. Setting up the psychological profile during the investigation

using the behavioral models in the FIB can reduce the circle of the potential perpetrators, and disclose us the real ones. It is obvious; this method is more efficient in re-incidents or reiterated crimes using similar Modus Operandi, perpetrated under similar circumstances, having similar features, etc. … At the same time, this comparison can exclude a number of potential perpetrators and thus the investigation can save precious time and reduce the costs of the investigation. It is also clear that every new criminal case has to have its CIB. After the case is closed, all these CIBs will be included into the General Information Base (GIB).

The Use of Artificial Intelligence (AI)

It is clear that even a higher level of efficiency may be achieved using artificial intelligence in information processing. The computer technology (CT) has been a reliable support for decades in law enforcement and it still has resources for further development. One of the fields of use of the newest achievements in CT is the widening use of AI not only for information processing, but also for searching information in every accessible information base according to the given parameters. AI can also carry out the preliminary analysis and assessment of the obtained information after combining and re-combining them following the goals of given task. For example: the AI can find sources of explosives, weapons, ammunitions for sale on the internet, and can combine it with previous information about looted items. Let us suppose that our Spanish colleagues have information about a terrorist bombing during an important event. The AI assisted preventive investigation will search for organizations interested in the terrorist act, their connections, the possible materials to be used for the terrorist act, the possible sources of these materials. At this point the AI can indicate that a couple of years earlier two hundred pounds of highly efficient explosive was stolen from Montana in the United States. Surprisingly, some explosives with the same features have appeared in the Darknet and bought almost immediately. It is a clear trace. With combination of the previous information with the new findings, one of the working hypothesis will be that the buyer of the explosives was the terrorist organization. In this case, different preventive measure may be taken to avoid the import of the material from abroad, and to find the load in the country. As I have written earlier, every new information can be the base for the forthcoming network analysis based on this given information.

In the case when particles of a new designer drug were found during the search of the house, after the definition of its chemical composition, the AI can indicate which illegal (or even legal) laboratory has produced the drug, what kind of previous information the anti-drug units have about the laboratory and the criminal organization operating it.

Another direction for using AI may be the permanent wide-range search in all the accessible information bases for information indicating potential challenges, risks and threats for security and safety. In this mode, the AI screens and filters the information bases trying to find even the remote links between the information components by recombining them as elements of possible networks. The wider is the range of screening, the more accurate is the warning about possible major crimes. Consequently, the more the acquired, calculated or supposed information is, the more precise is the predictability of the forthcoming phenomena in the process leading closer to the criminal acts.

FINDINGS

The above described dynamic analysis and assessment method to be called "Danube Analyst Method (DAM)" is unique since all the actual analyzing methods are based on static networks without considering the possible effects of the calculable or supposable information on the investigation progress.

The DAM is unique due to the permanent monitoring of the changing parameters influencing the investigation or process in question and their use for predictive analysis and assessment.

Another novelty of the DAM is that while the traditional investigation methods consider the facts, factors and information about them as stabile (definite, with constant value or significance) elements of the investigation process, the DAM differentiates their status, value and influence throughout the investigation or process in matter.

The DAM is a new method due to its information processing. This is the only method based on the dynamic network theory and the new information theory as a whole.

This is the first method assisted by the wide use of Artificial Intelligence (AI). Although many countries use the AI for different purposes within law enforcement, this is the first method using it in a complex way, beginning from the production of software to search, analyze and assess the information, through the permanent search for information using its own elaborated set of software and assisted by controlling software and other software for retrospective comparative analysis. The AI assists the analytical tasks not only by accelerating the information processing, but also up to pointing out the vectors/directions sorted in priority order of possible further development of the investigated process or the process in question. This dynamically evolving output gives a chance to plan the necessary response or preventive measures and to modify or specify immediately if necessary.

The DAM is the first multipurpose method applicable in different practical and scientific fields within law-enforcement and beyond. Its associative capabilities to select and arrange specified information in networks and to widen the frames of search by attaching newly created other networks even from other fields.

The DAM is an efficient tool to boost up the decision-making process, the implementation of which increases the efficiency of investigation and prevention. By applying the DAM, its users can save significant human, material and financial resources.

ORIGINALITY/VALUE

Being the first analysis method using the widest possible database and assisted by the fastest selection, systematization, processing, evaluation, assessment and double-checking in its every moment provided by the AI, this analysis and assessment method is capable to achieve a significant reduction of the time of preparation and making decisions in a wide range of law enforcement activities.

Instead of Conclusion

The complexity of dynamically changing tactical interests within the entities of larger groups of interests and also between systems of strategic interests is exponentially growing. Traditional approaches, technics and methods are already outdated since the multiplying challenges and new target areas

spread over and affect new field of life in every country. It would also be worth some scientific researches which will analyze the dynamism of the changes of interests, but it must be a task for scholars devoted to political sciences. We, who took our oath to serve, defend and protect the citizens, we are always behind the criminals and always react only when we are informed about something challenging our competence. It means one of the main goals of law enforcement bodies, the prevention of any possible kind of crime becomes more and more difficult. What our measures have to be if the act clearly harming public interest has not been codified yet? We perceive it is a crime but legally we are unable to apply the tools we are entrusted with. These cases are part of a permanent and sad learning. Our efforts may be useless unless the lawmakers, the governmental bodies not only understand the growing threat but also become active participants of the learning process, listen to our experience and use their legal position to reduce the reaction time between the criminal world and the law enforcement forces, between the committed crimes and legal sanctions.

Our colleagues from other countries are learning something each new day. They perceive, analyze and assess what they see, hear and experience on duty. They are overloaded; they have piles of files on their desks with problems of human beings like themselves to be solved. The officers, the lawmakers, the citizens need a new approach, a new tool, a new way to increase the security and safety, to reduce the risk of harmful activities for the societies. Let us think out of the box, let us give them this tool!

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