INTELLIGENCE NETWORKS[1] – *THE MODEL BASED METHODOLOGIES PROBLEM*

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Social innovation requires research regarding the profit potential of human interaction, in various settings and information environments. Throughout networking processes, the added value of information, together with organizational skills and methods brought into the system helps render a more efficient governance control of the national security systems. Previous studies showed the influence of social networks on political and business systems (Carley, 2002) as well as the need to create intelligent social structures, in order to foster innovation and competitive advantage (Steele, 2001). This paper examines the intelligence network concept and methodological issues contained in the structure design processes.

***Keywords**: Intelligence networks, network theory, methodology, metagraphs, innovation.*

INTRODUCTION

Network theory appeared in social science along with rising awareness about the role of knowledge in sustainability of systems. We introduce in this article the concept of *intelligence networks*, in order to explain and advance a new framework for addressing decision making processes for the national security.

Our primary objectives are the following: 1) to establish the role of the intelligence approach in contemporary security environment. Therefore, in the first part of this paper we will synthesize researches in intelligence theory and substantiate the leverage of this approach in regards with the policy for national security; 2) to introduce decision makers with elements and methodologies of the intelligence processes. The second part of the paper will describe old and new cycles of intelligence, and also outline the advantage of developing intelligence processes on networked structures; 3) and finally, to take forward intelligence theory and introduce a new method to improve intelligence processes. Thus, in the last part of the paper we will give an example of intelligence decision making and workflow, using mathematical structures called *metagraphs*.

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Researchers generally acknowledged that units in contemporary global system behave as information processing structures. The present interconnected environment emerged along with innovation in technology and communication mechanisms, and then rapidly extended to social sciences field, in order to describe social behavior and anticipate the building of social networks. From this step on, concepts like *network*, *complexity and dynamics*, acquired political significance and were introduced in decision making processes dealing with social, economic and political phenomena.

Furthermore, connections between and inside societies are maintained by informational flows and structures designed to warn against environment changes and system contenders. Thus, the emergence of network analysis in decision making systems remains highly linked with the need to evaluate risks and minimize uncertainty. The predictability value of a system has its source in the capacity of specialized units to gather, understand, and manage information.

We expect that, through intelligence networks, the following factors will be addressed: knowledge enhancement at social and governmental levels, organizational deficiencies in opposing asymmetrical threats, activity efficiency inside intelligence organizations.

The present paper is substantiated by previous studies in intelligence theory and the contemporary concern among researchers regarding the need to reform intelligence thinking and organization. Also, thanks to recent developments in graph theory, we are finally able to approach methodological aspects of intelligence.

Before engaging in discussing intelligence networks design, it is necessary to make some remarks concerning principals in intelligence theory, as well as policy recommendations of the intelligence community.

RESEARCH IN INTELLIGENCE THEORY

Writings having intelligence dedicated to national security as primary research study appeared at the end of World War II, introducing the work of Sherman Kent to a public consisting not only in members of the academia, but also officials from the political and military fields. His book, *Strategic Intelligence for American World Policy* – published for the first time in 1949, remained, for decades, the only most valuable resource for policymakers and members of the intelligence community. In his entire career, Kent was a supporter of the separation between the government officials and intelligence analysts, in order to preserve the unbiased characteristics of analytical products. On the other hand, he encouraged constant feedback and discussions between politicians and analysts, so as to create quality intelligence reports in accordance with the decision that had to be made by the American administration (Johnson, 2007:140).

Thus, intelligence theory was born at the beginning of Cold War era, when national power enhancement was the main objective of the US Government. The distinction made by Kent between politics and political science sets the fundamental definition of the intelligence community as impartial actor inside the

governmental apparatus. Recommendations for political officials are made based on intelligence estimates and reports, which spanned all relevant sources and used objective analytical methods. Kent (1949) defines the intelligence concept as *knowledge*, *organization* and *activity*. All three values combined produced an intelligence system which provided the basis for the courses of action to be taken in order to assure national security and power.

A decade after the demise of the Soviet Union, the intelligence literature is enriched with an abundance of studies taking into account the fundamental role of information and communication technologies. For the first time, workflow management in intelligence organizations is discussed, with special emphasis on the relationship between consumers and producers of intelligence, and the financial stakes governing allocation of tasks and acquisition of technical intelligence tools. Furthermore, the nature of conflict becomes highly important to define tasks for the intelligence community, along with cultural specificities beginning to dominate political configuration of the global system.

Contemporary approaches to intelligence are brought by Berkowitz and Goodman (2000), Michael Herman (2001), Gregory F. Treverton (2001), Loch Johnson (2003) and others, all of them stress the responsibility of researchers to create adequate methodologies, in order to fill the void in intelligence theory.

The incentives to write another book – on more or less the same methodological structure – are explained by Berkowitz and Goodman (2000), taking into consideration the need to change perspective on the use of information. Although, the conflict environment, the requirements for the community and the quality of technologies has further evolved, the most important reform must address the intelligence process. Authors begin by arguing that the old intelligence cycle cannot respond anymore to challenges coming from networked agencies, either because the workflow in the intelligence community is inefficient, or because the budget does not cover the expenses. As indicated by recent studies, American public opinion expresses the discontent towards budgetary spending for national security. Hence, one can anticipate that future budgetary allocations could be so reduced that the current management will not be able to sustain the intelligence process (Berkowitz and Goodman, 2000).

Gregory F. Treverton, former Vice Chair of the National Intelligence Council and Senate investigator, shows that today's intelligence puzzles may be answered only by acquiring expertise from specialists in the business field, academia members and think tanks researchers. In his work, *Reshaping National Intelligence for an Age of Information*, the new paradigm describes intelligence community as part of the market state, in which secrets have lost their power, in favor of open information sources.

Although premises of an intelligence theory appeared primarily in the United States, a powerful intelligence organization and research community can be found in the United Kingdom. Michael Herman – British Intelligence professional and Oxford University academic – makes a remarkable contribution to the research field, by comparing the US and British Intelligence systems. He draws the

distinction between English-speaking intelligence – as all-source, expert, objective products – and traditional intelligence – based mainly on covert action, politically biased and consequently, subjective (Herman, 2001). British government granted enhanced surveillance powers to military forces and secret services MI5 and MI6, on the principle that states the following: "societies in their entirety are at war, not only their armed forces" (Dandeker, 1994). As opposed to the American system, where government officials created the intelligence capability as a response to an outside enemy, the British system concentrated on internal security and law enforcement (Dandeker, 1994).

In recent years, intelligence systems emerged outside the governmental framework and spanned the business and social fields. Intelligence units similar to intelligence communities inside the governmental apparatus have taken over management branches of companies and organizations. A special emphasis is placed on Open Source Intelligence (OSINT) systems. Robert David Steele – CIA professional and founder of Open Source Solutions Inc. – explains why open sources are the appropriate tools in the future of intelligence. According to his argument, "OSINT is uniquely suited for support to national security operations because OSINT relies exclusively on information and expertise obtained through legal and ethical means" (Steele, 2001).

Since the acknowledgement of intelligence as primary element in strategic choice decisions, private organizations began to take charge not only of tasks concerning national security, but also of social security programs and risk management for business enterprises. The extension to new domains required diversification of methods and instruments employed to generate value. Thus, theories from social sciences combined with mathematical and technological resources improved results' quality and reduced time in information processing. In recent years, the connection between public and private spheres became particularly interesting for decision makers. Economic, social and political elements – either at national or international levels – influence each other through formal (legislation) and informal means (social norms, private negotiation). Therefore, the development of a public policy implies analysis of relevant factors, taking into account the relative impact on political, social, economic, cultural and technological dimensions of national well-being. From this point of view, a powerful instrument in attaining efficiency is the control of information assets and flows.

The work of Kathleen M. Carley (2002, 2004) gives responses concerning the need to see social networks as channels for transmitting or receiving information. Their specific structure and functions make them more or less durable to actions from external agents. Kathleen M. Carley et al. (2002) argue that, by identifying critical nodes through evaluation of centrality and cut-points in the structure of a social network, one could alter their performance. Thus, the sustainability and efficiency of a network depends largely of its design.

Another largely discussed issue is the identification of relevant actors to form an efficient network. Intelligence theorists agree that intelligence agencies inside

governmental apparatus must collaborate with business actors, non-governmental organizations and citizens, in order to ensure their need of informational resources. Two reasons underpin this argument: the first one refers to the accessibility to information obtained from open sources and to quality analytical products; the second one relates to the price of information obtained from open sources, which generates financially advantageous intelligence services.

Furthermore, Robert David Steele (2001) recommends the involvement of citizens in intelligence activities. Thus, he insists on the creation of collaborative networks, which could involve individuals in their own security. The primary goal of decision makers should be the creation of smart nations (Steele, 2006). Smart nations imply the existence of smart citizens, capable of conscious self-control (Bandura, 2001). Security – in particular, national security – and competitive advantage policies could be better addressed in cohesive communities. However, this evolutionary leap must be sustained with educational reforms and public policies promoting learning strategies and capabilities adequate to knowledge level of the society. Intelligence networks have the potential to connect public actors, private actors and citizens into a cooperation relationship, based on common identity and common interests.

The second part of this paper describes decision making and planning activities inside an intelligence agency with responsibility in national security.

SYSTEMS OF INTELLIGENCE

Previous remarks concerning the *intelligence network* concept for political decision making had been made by Tom Stonier in an article published in 1986. The author argues that an increasing number of information networks will lead to the emergence of a "global central nervous system". According to his argumentation, machine intelligence systems would be able to produce and sustain – in the near future – to the benefit of the humankind, an effective collective memory, based on which decision makers will solve complex problems (Stonier, 1986: 269–274). Hence, to some extent, the intelligence network concept extracts his meaning from the revolution in communication technologies. Previous studies in mathematics have preceded and induced this kind of argumentation.

Remarkable contributions were made by Alan Turing in computer science since 1936, setting the basis for a debate regarding artificial intelligence concept. The question of the state of consciousness of a machine remained unanswered until today, yet it opened the discussion whether machines are or could become intelligent. In 1950, Alan Turing wrote on this subject an article entitled *Computing Machinery and Intelligence*, in which he describes a test he created in order to demonstrate the ability of a machine to think.

Nowadays, the debate concerning intelligence shifted in the social and political science arenas. Although there is a certain detachment from the

mathematical thinking, researchers are still bound to recur to mathematical models, in order to define systems and organize processes.

However efficient and revolutionary may be mass communication technologies, their usage modified the properties of the global social system. The flexibility in transmitting information, the facilities in transporting people or goods, the access to all sorts of products, have created an uncertain environment for individuals and subsystems, or what is generally called *the risk society*. At this stage, researchers turned to linear algebra to find proper models in explaining some of the trends in contemporary society. One of them is the creation of social networks. The utility of studying the creation and composition of social networks consists in anticipating relationships, interests and the informational flow (Basu and Blanning, 2007:158).

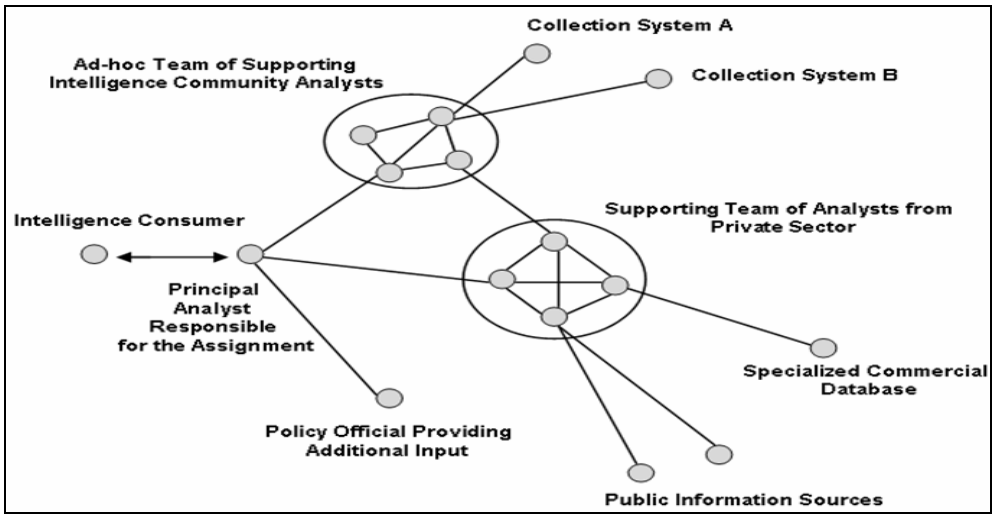
In the intelligence communities, networking as explanatory and anticipating model impacts on policies regarding the management of information for national security. Networks are important to intelligence specialists, because they constitute the morphology at the basis of terrorist organizations, organized crime chains, cyberspace warfare and other security threats.

The activity inside an Intelligence community follows bureaucratic imperatives – well known by the intelligence professionals and researchers as the *intelligence cycle*. A traditional intelligence cycle begins with a problem. Thus, a government official or a policy maker formulate a set of questions regarding a certain issue with consequences on national security and then transmits it to the group of analysts from the Intelligence community. After setting priorities, tasks are assigned to intelligence organizations, which begin to collect data and information from primary and secondary sources. Further, analysts study and process the newly collected information and express first hypotheses on the matter. If more information is needed, the collection process is resumed with new requirements. At the end of the analytical stage, the intelligence team produces a report, which will be further delivered to the consumer. These steps are basically the same today as they were first formulated some sixty years ago, by Sherman Kent (1949). However, experienced professionals acknowledge that officials rarely have the time or disposition to raise precise questions. Actually, needs are implied by analysts based on some general directions from the officials. More often, decision makers expect warnings from the intelligence when problems arise (Hulnick, 2007).

Profound transformations in the intelligence environment provided serious incentives for policymakers to sustain the reform of the intelligence organization. According to Berkowitz and Goodman (2000:74), organizations must become more flexible and allow configuration of working teams formed by collectors and analysts in a freely manner. Further, the authors enunciate the advantages of this new model as follows: as opposed to the traditional model, a decentralized team includes three types of intelligence analysts – analysts that are linked to users and paid by them, "super analysts" responsible for resource allocation and communication with consumers, and specialized analysts from the private sector. Moreover, given the new network morphology, the organizational structure is more fluid. The analysis products are disseminated directly to users, without passing through the quality control process.

Figure 1

An Example of Intelligence "Virtual Team"



Source: Berkowitz and Goodman, 2000:80.

The new team is always prepared to provide timely analytical products if unexpected assignments appear. Finally, managers recruit part-time contractors, in order to integrate them in a team whenever a requirement appears. (Berkowitz and Goodman, 2000:85–86)

The above graphic represents a network composed by an ad-hoc team of supporting Intelligence community analysts, a supporting team of analysts from the private sector, a principal analyst responsible with the assignment and a policy official providing additional input to the process. The ad-hoc team provides new data from collection system A and collection system B. Also, analysts from the private sector supply information from specialized commercial database and public sources. Finally, the product resulting from their activity is delivered to the consumer.

One observes in this model the variety of used sources, from in-house collection systems to public information, which could be provided in real-time by the media. Further, this virtual team includes specialized individuals, having high knowledge about factors creating the problem. It is important to outline that networked structure workflow provides flexible interaction processes and reduces time needs for producing intelligence. Moreover, the collaboration between consumers and analysts is also represented in the above model, although the exchange of information could be even higher. Permanent interaction between decision makers and intelligence staff, all along the intelligence process, is highly recommended by theorists.

However, the above diagram does not solve some methodological problems of the analytical process. Firstly, relationships between and inside teams are not

directed, which brings lack of information concerning the functions performed by each element in the system. Secondly, the virtual team diagram cannot be used to identify critical relationships and to assess its efficiency.

In the last part of the paper, a new methodology for the intelligence process is advanced, by introducing metagraphs as mathematical structures able to capture connectivity attributes of the intelligence systems models.

THE MODEL BASED METHODOLOGIES PROBLEM

Methodological requirements for the intelligence system came from two directions. From the internal perspective, intelligence processes taken place inside intelligence organizations demanded restructuring, since problems changed so radically and the traditional bureaucratic design was no longer efficient. Problems of communication between and inside agencies, between the consumer of intelligence and the analysts, between analysts and collectors of information, induced the idea that a more complex planning design was needed. Also, network methodological aspects offer a second perspective over the structure and functions of threatening systems in the global environment. The flexibility of networks may allow the well-known problem of asymmetrical courses of action in conflict situations.

The representation of networks through graphs opened the way to make assumptions about relationships and structures based on several attributes, such as *the degree of connectivity*, *the centrality of units* in a network, *critical units* and paths (Harary, 1969). Network building models, as well as network destabilization processes are highly debated issues, with consequences in various fields of decision making. Thus, the utility of networks creation methodology can be observed in regards to model management, workflow organization procedures, and data and rule management tasks (Basu and Blanning, 2007). On the other hand, destabilization of networks discussion finds its meaning in security issues arisen in last decades. Kathleen M. Carley et al. (2002) examined the capacity to destabilize large, distributed networks, consisting of actors connected through various socio-demographic dimensions. The article outlines the importance to locate nodes, links and their attributes – whether in an alliance, communication systems, financial flows – since based on these observations one could affect the stability of a network by removing critical nodes or linkages (Carley et al., 2002).

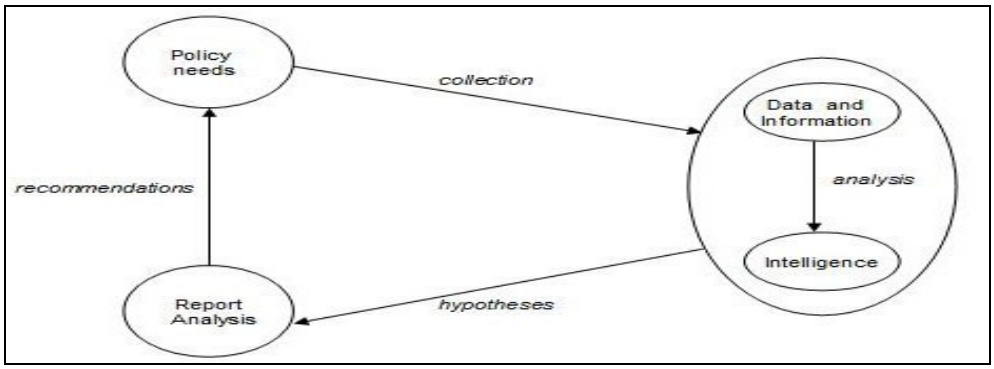
From the intelligence point of view, these two perspectives offer incentives for treating problems regarding national security based on network modeling and analysis. The selection of a type of graph to use in building networks is directly related to the purpose of the graph and the complexity of the problem. In this paper we use metagraphs, in order to build a model management process and an intelligence workflow system.

Graphs are defined as diagrams consisting in a set of points, also called *nodes* and a set of ordered or unordered pairs of nodes, also called *edges* (Basu and Blanning, 2007:vii). Since simple and directed graphs can only illustrate relations between individual elements, researchers have introduced the *hypergraph* concept which shows connectivity between sets of elements. Furthermore, *metagraphs* appeared as a necessity to illustrate directed set-to-set mappings.

Decision models are part of information processing systems. When represented as metagraphs, decision models illustrate an input-to-output mapping of a model, which corresponds to the set-to-set mappings in a metagraph edge. The edges in a decision model metagraph are collectively called the "model base" (Basu and Blanning, 2007). In this situation, the analysis emphasizes the relationship between models and their position inside the process.

Figure 2

Intelligence Decision Model



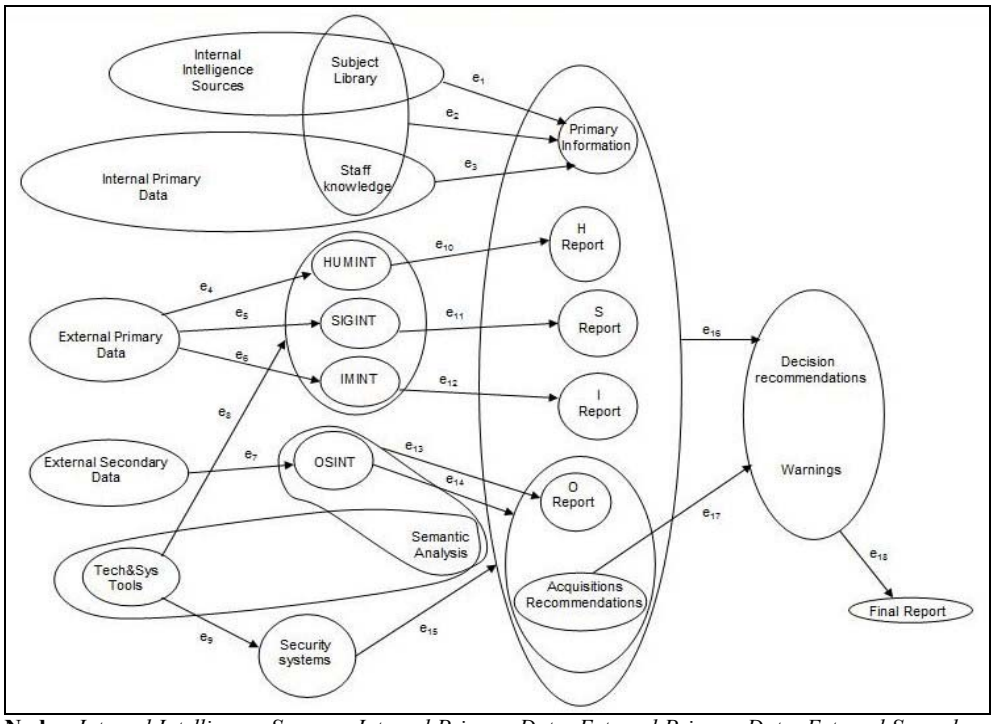
The intelligence decision model illustrated in *Figure 2* consists in four elements: policy need, data and information, intelligence, and report analysis. Thus, *policy needs* is a pure input. *Intelligence* element depends on data and information. *Data and information* element along with *intelligence* element are both depending on policy needs. *Report analysis* depends on data and information, as well as on intelligence. Finally, policy depends on the report analysis provided by the Intelligence community.

There are four models which compose the model base: the collection model, the analysis model, the hypotheses model and the recommendation model. The collection model has as input policy needs element and as output data and information and intelligence. The analysis model has as input data and information and as output intelligence. The hypotheses model has as input data and information and intelligence and as output report analysis. The recommendations model has as input data and information and intelligence and as output policy needs. This metagraph describes a cyclic model base.

The intelligence workflow represented in *Figure 3* shows the manner in which informational, technological and human resources interact, in order to produce the final intelligence report.

Figure 3

Intelligence Workflow Model



Nodes: *Internal Intelligence Sources; Internal Primary Data; External Primary Data; External Secondary Data; Tech&Sys Tools (Technical and systems tools); Security systems; Subject Library; Staff knowledge; HUMINT: human intelligence; SIGINT: signals intelligence; IMINT: imagery intelligence; OSINT: open source intelligence; Semantic Analysis; Primary information; H Report: HUMINT report; S Report: SIGINT report; I Report: IMINT report; O Report: OSINT report; Acquisitions Recommendations; Decision recommendations; Warnings: new subjects inferred by the Intelligence community; Final Report.*
Edges e_1*: collecting internal secondary sources;* e_2*: collecting knowledge on the subject from internal secondary sources and staff;* e_3*: collecting internal primary data and staff experience;* e_4*: analyzing external primary data from which will result HUMINT;* e_5*: analyzing external primary data from which will result SIGINT;* e_6*: analyzing external primary data from which will result IMINT;* e_7*: analyzing external secondary data;* e_8*: securing HUMINT, SIGINT and IMINT;* e_9*: producing/acquiring security systems;* e_{10}*: processing the HUMINT report;* e_{11}*: processing the SIGINT report;* e_{12}*: processing the IMINT report;* e_{13}*: processing the OSINT report;* e_{14}*: processing the OSINT and Acquisitions Report;* e_{15}*: securing intelligence products;* e_{16}*: processing decision recommendations and inferring needs (warnings);* e_{17}*: processing recommendations for acquisitions;* e_{18}*: processing the final report.*

As opposed to a diagram, the metagraph model is explicit in respects to relationships between informational entities and functions that are being performed. Primary and secondary sources from inside and outside the intelligence agencies are being processed by specialized staff, in order to produce intermediate reports.

First hand information and data is collected from internal sources, particularly from libraries and specialized staff, in order to make hypotheses regarding the

customers' subject needs. Human intelligence, signals intelligence and imagery intelligence reports are developed by technologies gathering information from external sources, in a permanent manner. Based on these reports analysts make new assumptions or complete their data about the subject advanced by decision makers. Also, new information could add to intelligence warning reports. The open source intelligence report is created by specialized analysts using external secondary data and information from the media, the internet and other documents and reports. Taking into account the large amount of information available from open sources – about 80% from the actual needs of the intelligence analysts (Steele, 2008) – the importance of the OSINT report is critical. Technologies assure the efficiency of the information gathering processes, the security of intelligence reports and the acquisitions recommendations. Also, semantic analysis depends largely on innovative techniques and methodologies. The final report is created by analyzing reports from specialized agencies and producing decision recommendations. The intelligence workflow presented in the *Figure 3* combines the functional modeling – tasks that are being performed by the informational elements, with the organizational modeling – agents and resources involved in the process, the informational modeling – the structure and relationships between informational inputs and outputs, and the transactional modeling, concerned with tasks sequencing and control[2].

FINAL REMARKS

The intelligence networks concept represents an asset for intelligence communities and decision makers, since it helps creating a clearer image about systems and their corresponding environments. Also, networks provide anticipation of future configuration of the system for which they are created, minimize the asymmetry in conflict situations, and assure a better organizational environment for intelligence activity. Their structure and shape provide input information about actions that could be undertaken to destabilizing them. Graph theory assured sufficient material, in order to build networks that are sustainable and efficient.

This paper examined, in a brief manner, intelligence theory, its impact on policy making and the reasons to address challenges to intelligence activity through network theory. Our future studies will approach intelligence networks and methodologies from a more complex perspective, including specific metagraph connectivity attributes and applications, which require mathematical abstraction.

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[2] For a broad explanation of the four perspectives used in process representation with metagraphs, see Basu and Blanning (2007).

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Procesele de inovare socială necesită inițiative de cercetare privind potențialul de profit al relațiilor interumane, în diferite condiții şi medii informaționale. Prin intermediul structurilor rețelare, valoarea adăugată a informației ajută la definirea unui control guvernamental mai eficient asupra sistemelor de securitate națională. Studii anterioare au arătat influența rețelelor sociale asupra sistemelor politice şi economice (Carley, 2002), precum şi nevoia de a crea structuri sociale inteligente, pentru a cultiva spiritul inovativ şi avantajul competitiv (Steele, 2001). Această lucrare abordează conceptul „rețea de intelligence*", precum şi problemele metodologice conținute de procesele de modelare structurală.*

***Cuvinte-cheie**: rețele de intelligence, teoria rețelelor, metodologie, metagrafuri, inovare.*