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Complexity of social systems and paradoxes of contemporary security theory and policy making

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1. Introduction

The grand ideas such as, for example, the risk society of Beck [1992], complexity-stimulated crises discussed by Tainter [1988, 2000], Diamond [1997, 2005], ingenuity gap of Homer-Dixon [2002], and other similar, less publicized visions, lead to the following question. Was the world simpler and less risky in the past? The question brings about several paradoxes embodying actors and issues relating to broadly defined security. On the one hand we are intuitively aware that the present global society with development of IT and all its consequences, increasing number of societal interactions and environmental threats is becoming more difficult to comprehend. On the other, modern science allows for better understanding of the world. It may be then hypothesize that the contemporary discourse on the risk society and complexity of society is not correct when compared with the state of the world in any time in the past and much lower level of understanding of the world in that time. It may be even stated provocatively that although the number of social scientists is increasing only a relatively small of them have a deepened knowledge about the modern social proceses.

The above paradox is used as a point of departure of the study of the links between complexity of society in the past and at present, and occurrence of large scale socioeconomic crises (countries, regions, continents, global scale). It will be argued that the term complexity, which according to Lloyd has about 45 interpretations, can be reduced to increasing incomprehensibility. This new definition of complexity of social systems proposed in the paper is a point of departure for identification of paradoxes affecting policy makers and advisors. How to understand the situation when we have thousands of specialists, research centers, think-tanks claiming to study risk, to develop foresight, to make scenarios, etc. when, at the same time, it can be observed that too many erroneous political decisions are made? Are the advisors not correct,

so they are useless, or perhaps, they do not have a sufficient impact on policy making? As to analyze such a situation, the concept of quadrangle of paradoxes is developed. It embodies paradoxical relations between new interpretations of complexity of social systems, the impact of advisors, the role of policy makers and surprising and unpredicted (unpredictable?) threats to security in the contemporary world.

2. Complexity of social systems

2.1. Definitions of complexity

Complexity is undoubtedly one of most popular notions applied in the contemporary science and policy making. Studies of complexity are rooted in cybernetics and systems thinking . The first attempts to define and study complex entities go back to the works of Weaver (1948) (disorganized complexity and organized complexity), Simon (1962) - the Architecture of Complexity, and Ashby (1963) – the Law of Requisite Variety. In his search for explaining the meaning of complexity, Lloyd (2001) identified 45 methods of describing complexity. A very convincing picture of intricacy of the field of complexity science can be also found in the scheme proposed by Castelani (2014). In other writings numerous definitions of complexity have been formulated and scrutinized – Prigogine & Stengers (1984), Waldrop (1992), Gell-Mann (1995), Kauffman (1993, 1995), Holland (1995), Bak (1996), Bar-Yam (1997), Biggiero (2001), Prigogine (2003).

Unequivocal distinction of complex systems from the "classical" systems is not possible. In the works by Wiener (1948/1961), Ashby (1963), defining "first order cybernetics" and 'hard' systems thinking Bertalanffy (1968) - without considering the role of observer, complexity was treated as one of important systemic features. In those works the first systemic/cybernetic characteristics of systems were enumerated: system, element, relation, subsystem, environment, input, output, feedback, black box, equilibrium, stability, synergy, turbulence.

In a preliminary approach complexity of systems derives from the number of elements and of their interactions. Furthermore, it can be also characterized by multitude of such traits as adaptability, adaptation, attractor, *autopoiesis,* chaos, bifurcations, butterfly effect, closed system, coevolution, complex adaptive systems, dynamical systems, edge of chaos, emerging properties, far-from-equilibrium states, fitness landscape, fractals, nonlinearity, open system, path dependence, power law, reflexivity, scale-free networks, self-organization, self-organized criticality, self-reflexivity, synergy, synergetics, turbulence. Those ideas are extensively depicted

in a large number of writings of which only a small fraction are quoted in this chapter Impossibility of decomposition and incomprehensibility are also treated as important facets of complexity. Gell-Mann (1995) shows that complexity can be treated as a function of the number of interactions between elements in a system. Nicolis and Prigogine (1989) prefer measures of complexity based on system 'behavior' rather than on any description of system interactions. Similarly, behavior is also a foundation of analysis and description of CAS (Complex Adaptive Systems) (Holland, 1995).

Ideas originated in systems thinking and complexity studies are used in social sciences as models, analogies and metaphors. According to this distinction, the term 'model' is narrowed only for mathematical structures. Mathematical models in complexity studies can be applied in three areas: computing-based experimental mathematics, high precision measurement made across various disciplines and confirming 'universality' of complexity properties and rigorous mathematical studies embodying new analytical models, theorems and results.

Models, analogies and metaphors are instruments of theories in social sciences and are applied for description, explanation of causal relations, prediction, anticipation, normative approach, prescription, retrospection, retrodiction, control and regulation, or in a modern approach, influence upon the system (Lakoff, & Johnson, 1980/1995). It is also worthwhile to add that models, analogies and metaphors deriving from systems thinking/complexity studies are gaining a special significance in the social sciences. They are treated as 'scientific' and obtain supplementary political influence resulting from 'sound' normative (precisely prescriptive), legitimacy in any debate on security theory and policy.

It must be mentioned that contrary to physics, chemistry and biology, where only mathematical models are applied in prediction, in social sciences it is also the qualitative considerations that are used in prediction. Therefore the role of analogies and metaphors taken from complexity studies must be taken into account with a sufficient care.

One of most influential ideas of complex research are the scale-free networks elaborated by Barabási and Albert (Barabási, Albert, 1999; Barabási, 2003). After finding that various networks, including some social and biological networks, had heavy-tailed degree distributions, Barabási and collaborators coined the term 'scale-free network' to describe the class of networks that exhibit a power-law degree distribution, which they presumed to describe all real-world networks of interest.

2.2. "Hard" and "soft" complexity

The above ideas can be called 'hard' complexity research as an analogy with the 'hard' systems thinking, and to some extent, with the 'first order cybernetics'. It includes mathematical modelling of systems with well-defined and measurable characteristics in physics, chemistry, natural sciences and in society . The soft' complexity research, also coined per analogy with 'soft' systems thinking and 'second order cybernetics', includes the ideas of complexity elaborated in other areas – cybernetics and systems thinking, social sciences and in psychology[1]. Those ideas can be divided into two groups. The first group includes those, which are based upon analogies and metaphors drawn from 'hard' complexity studies and they are dominating in social sciences theory and practice being very often abused and misused (Gleick,1987; Castelani, 2014). The second group includes indigenous qualitative concepts of complexity like, for example, those elaborated by Luhmann (1995).

Subjectivity is the first aspect of complexity in the 'soft' approach. Following this line of reasoning, from the point of view of the second-order cybernetics, or in a broader approach, constructivism (Glasersfeld, 1995; Biggiero, 2001), complexity is not an intrinsic property of an object but depends on the observer. Usually it is stated that 'complexity, like beauty is in the eyes of the beholder".

As to identify a genuine epistemological meaning of complexity, based on some properties of the relationships between observers (human or cognitive systems) and observed systems (all kind of systems) Biggiero (2001: 3) treats predictability of behavior of an entity as the fundamental criterion for distinguishing various kinds of complexity. He proposes three classes of complexity: (a) objects not deterministically or stochastically predictable at all; (b) objects predictable only with infinite computational capacity; (c) objects predictable only with a transcomputational capacity. Coming from this typology, he defined 'observed irreducible complexity (OIC)' as those states of unpredictability, which allow to classify an object in one of those three classes. This definition allows to distinguish semantically complexity in the new sense.

[1] Similar considerations concerning "soft" and "hard" complexity (Lissack are used as inspiration

The typologies presented by Biggiero lead to two conclusions important in studying social systems. Firstly, self-reference characterizes the first class, which relates to the many forms of undecidability and interactions between observing systems (Foerster, 1982). This property being a foundation of 'second order cybernetics', in some sense favors the subjective interpretations of complexity. Second, human systems are characterized by the presence of all sources and types of complexity (Biggiero 2001: 4-6). It may be then summarized that human systems are the 'complexities of complexities'. In social sciences, and particularly in sociology, attention is given to the concepts of complexity of systems proposed by Luhmann. It's the main idea of 'soft' complexity, akin to 'second order cybernetics'. As one of a few authors, Luhmann has made an attempt to provide a comprehensive definition of social system based solely on communication and on the concept of *autopoiesis* (self-creation) of biological systems. According to Luhmann, a complex system is one in which there are more possibilities than can be actualized. Complexity of operations means that the number of possible relations becomes too large with respect to the capacity of elements to establish relations. It means that complexity enforces selection. The other concept of complexity is defined as a problem of observation. Now, if a system has to select its relations itself, it is difficult to foresee what relations it will select, for even if a particular selection is known, it is not possible to deduce which selections would be made (Luhmann, 1990: 81).

A deeper analysis of defining and functioning of all kinds of systems allowed Luhmann to propose a definition of system as the mean of reduction of complexity of its environment. He proposed four steps of creating the concept of social systems (Bednarz 1984: 55-59). Luhmann considers the concept of system as serving the reduction of complexity through the stabilization of an inner/outer difference. In this interpretation the concept of complexity assumes central importance because any system's raison d'être is the reduction of the overwhelming complexity of the world to a manageable format. However, this is particularly important in Luhmann's case because only through this concept does a sociology which understands itself as the theory of social systems - as Luhmann's does - manifest its basis in the a-cybernetic and a-sociological theory of world interpretation already mentioned. According to Luhmann (1970: 116) systems are essentially, "...islands of lesser complexity in the world'[2].

Various kinds of systems reduce the complexity of the world in different ways. Physical and organic systems do this through built-in or natural structures and processes. Psychological and

[2] Quotations of Luhmann's early work after Bednarz (1984: 58).

social systems do this through the use of meaning, according to Luhmann. In any event, every open system presupposes a relation to the world - as the limit of its own environment - which is expressed as a difference in degree of complexity. Every open system is confronted with an overwhelmingly complex world whose complexity it must reduce in order to exist. The term 'overwhelming complexity' refers to the fact that the world excludes no possibility. Therefore it can never be interpreted as a system because every system implies an outside and how can anything which excludes no possibility ever be conceived as having an outside?

Complexity of social system developed by Luhmann is strongly linked to self-reference since reduction of complexity is also a property of the system's own self-observation although no system can possess total self-insight. This phenomenon is representative for epistemology of modern social sciences, where observation and self-observation, reflexivity and self-reflexivity, self-reference and subsequently intersubjectivity are playing an important role. According to this interpretation, social systems are becoming self-observing, self-reflexive entities trying to solve arising problems through the processes of adaptation (learning).

Taking an epistemological stance which can be called a moderate constructivism, it should be emphasized that definitions of all categories have not any "objective' character, independent from the observer. It is a basic epistemological assumption in modern social sciences. Therefore in systems thinking, including both 'hard' and 'soft' complexity intersubjective interpretations of concepts are the point of departure of investigations.

The links between intersubjectivity and complexity of all kinds of systems has to be further investigated. The challenges stemming from intersubjectivity are of a special importance in the discourse on 'soft' complexity where reflexivity, self-reflexivity and self-reference are taken into consideration. This issue is thus crucial for social systems in which the systemic properties are always the constructs of participants/observers. Paradoxically, with a few exceptions those links have not been yet analyzed in a more comprehensive way.

Intersubjectivity is one of key issues of modern psychology and sociology although there is not any commonly accepted definition of that notion. Bednarz (1984) made an initial attempt to investigate how intersubjectivity is connected with the concepts of social system of Luhmann. In the Bednarz's approach the Husserl's (1970) idea of transcendental intersubjectivity is treated as the source of all objectivity and meaning - including that of the world itself. Intersubjectivity should be always be borne in mind during defining and studying social systems.

2.3. Nonlinearity, intersubjectivity, and complexity

Complex systems exhibit non-linear behavior that is referred to as positive feedback where internal or external changes to a system produce amplifying effects. Non-linear systems can generate a specific temporal behavior which is called chaos. Chaotic behavior can be observed in time series as data points that appear random, and devoid of any pattern but show a deeper, underlying effect. During unstable periods, such as chaos, non-linear systems are susceptible to shocks (sometimes very small). This phenomenon, called 'sensitivity to initial conditions' and popularized as the Lorenz's 'butterfly effect', exemplifies the cases, where a small change may generate a disproportionate change (Gleick, 1997). The major lesson of non-linear dynamics is that a dynamical system does not have to be 'complex' or to be described by a large set of equations, in order for the system to exhibit chaos. When recalling non-linearity and its consequences in complex systems two phenomena should be reminded. Firstly, as Stanislaw Ulam once remarked, discerning non-linear phenomena and their mathematical models was "like defining the bulk of zoology by calling it the study of 'non-elephant animals'." His point, clearly, was that the vast majority of mathematical equations and natural phenomena are nonlinear, with linearity being the exceptional, but important, case (Campbell, 1997: 218). Secondly, it should be also mentioned that the divide, linear is predictable and non-linear is not predictable, is a simplification. For instance, Newton's equations for the two-body Kepler problem (the Sun and one planet) are non-linear and yet explicitly solvable. It means that non-linearity not always leads to chaos. At the same time the fundamental equation of quantum mechanics, the Schrödinger's equation is absolutely linear (Sokal, & Bricmont 1998: 144-145).

2.4. Complexity of social systems as awareness of incomprehensibility

Although the discussion upon definitions of information and meaning, complexity and information overabundance can be continued endlessly, the above considerations seem sufficient from the point of view of studies of the links between information explosion, information overload and complexity of management of contemporary organizations. The common sense strengthened by the above considerations shows that there exist a plethora of links between the complexity of all kinds of social systems, and all meanings of information. Those links determine and are determined by consequences of information abundance (information explosion and information

overload). Multiple meaning of information and multiple meaning of complexity can be used as a point of departure for proposing a new approach to the latter. Although information and complexity can be defined for all types of systems – natural, abstract (mathematical), physical, due to the topic of the paper, attention is focused upon social systems, and particularly upon organization as understood in management theory and practice.

The proposed new approach to complexity of social systems is at present only a preliminary concept but it is built upon the existing body of knowledge about complexity studies and information. In the further studies some of its aspects can be operationalized and quantitative measures can be either adopted from the existing ideas or developed in the future. Although this new idea of systems complexity is of a universal character yet the attention herein is focused upon social systems, with particular stress on organization defined in management theory and practice. The assumptions of the concept of complexity of social systems can be described as follows. In all earlier attempts which were made in broadly defined systems thinking, the system was treated as a kind of spatial and temporal ordering with the invariants constituting its structure (systemness). Those invariants were latently defined in such a way that they could be changing yet the patterns of their change remained within a predictable scope allowing for maintaining system's identity. So it was assumed that it was known how to identify or to build the system. Initially, in first order cybernetics, the systems were defined as remaining independent from the observer, thus they could be treated as "objective", or using a more modern approach, as a kind of more or less precisely understood results of intersubjective discourse. Of course, such an approach was rooted in modernist thinking based upon biological and mechanistic analogies and metaphors. However, the system could be defined as an entity clearly distinguishable from the environment and observer. Such systems had some properties which were irreducible and that is why the idea of complexity was applied to them, e.g. disorganized and organized complexity.

Weaver (1948: 538) defines disorganized complexity as: …a problem in which the number of variables is very large, and one in which each of the many variables has a behavior which is individually erratic, or perhaps totally unknown. However, in spite of this helter-skelter, or unknown, behavior of all the individual variables, the system as a whole possesses certain orderly and analyzable average properties".

Organized complexity was characterized in a different manner (Weaver, 1948: 539):

“Is a virus a living organism? What is a gene, and how does the original genetic constitution of a living organism express itself in the developed characteristics of the adult? Do complex protein molecules "know how" to reduplicate their pattern, and is this an essential clue to the problem of reproduction of living creatures? All these are certainly complex problems, but they are not problems of disorganized complexity, to which statistical methods hold the key. They are all problems which involve dealing simultaneously with a sizable number of factors which are interrelated into an organic whole. They are all, in the language here proposed, problems of organized complexity”.

The above distinction of types of complexity dominated the first order cybernetics, with observer remaining outside the system. It was continued with the developments of “hard” complexity, referring to non-linearity, emerging properties, chaos, etc., which were described in detail in the earlier part of this paper.

The second type of complexity, the “soft” complexity connected with the second order cybernetics and “soft” systems thinking brought about the observer who not only observes the system but creates it and defines it’s meaning. Re-reading the interpretations of complexity presented earlier a question is arising – what are the links between “systemness”, i.e. possibility of identifying order in social systems and complexity expressed with limited possibility of identifying this “systemness”. In other words, it must be stated that complexity reflects increasing cognitive problems with identification of order, structure, i.e. systemness.

Here the role of broadly defined information overabundance should be taken into account. Complexity, both “hard” or “soft” reflects the situation that increasing amount of information brings about increasing awareness of the lack of information. In other words, when we know more, we know what we know but at the same time, we better know what we do not know. We also realize that there are more aspects of the system and of the environment about which we know that we do not know that we do not know. For “hard” systems thinking it means that the observer, independent from the system, has to deal with increasing amount of external information presented in operationalizable forms. Obviously, according to constructivist approach, this “external” picture results from intersubjective discourse but the meaning which is created is expressed predominantly with operationalizable (quantitative) characteristics, with all weaknesses of operationalization taken into account. In this case the problems of interpretation and meaning, although important, only in a limited range hamper the studies of the system.

In the case of "soft" systems depicted with verbal characteristics, and to some extent" with numbers, the situation is much more intricate. In the case all consequences of information overload affecting the observer (participant, author) contribute to increasing amount of information and infinite number of potential interpretations. Reflexivity, self-reflexivity and self-reference make the challenge of describing and defining complexity even more intricate.

As to make this picture even more opaque, it must be reminded that social systems viewed from the point of view of constructivism have several intertwined hierarchical properties. Focusing attention upon management, it can be concluded that the observer (participant, author) while observing (creating) social system in his/her mind and later, in the intersubjective discourse, has to deal with the following hierarchies:

1. Hierarchy of inclusions (physical or intangible) – system, subsystems, sub-subsystems, etc. (Simon, 1962).
2. Hierarchy stemming from a large, if not infinite, number of potential systems which can be created upon the basis of the observed system (imposed upon observed system).

As an example of the latter the case of multiple description of organization with different metaphors by Morgan (1996) can be quoted. For one group of observers organization looks as machine but with personal relationships imposed onto itself, e.g. friendship or competition. So observing the organization we can or we cannot see that behavior of the employees reflect not only their cooperation in work but also friendly relationships. So we have to deal with two or even more organizations depicted with different interpretations – metaphors and mathematical models.

No matter, how intricate this paradoxical reasoning may seem, the basic conclusion concerning both "hard" of this reasoning is that complexity ("hard" and "soft") results from increasing amount of information and increasing possibilities to define meanings on the basis of this information. Therefore the following definition is proposed:

Complexity of social systems can be defined as awareness of the observer/participant/author of limitations of possibility to capture the system's properties ("awareness of incomprehensibility (ignorance)"). It is resulting from increasing amount of information achievable and subsequently, from the number of potential meanings built upon this information.

The proposed general definition stands in agreement with all already discussed interpretations of complexity. Further deepened investigations should allow more specific features

of this definition adapted for social systems and for all classes of systems. Taking as a point of departure the above definition, it has the following consequences for the considerations on complexity of social systems, including organization defined as in management theory:

1. Complexity is a result of increasing amount of information achieving the observer/participant/author. Paradoxically, in some cases complexity can be better understood by rejection of information. It is a consequence of the following paradox. If complexity is the equivalent to result of awareness of the lack of information, then it is necessary to reject information about the system which includes information useful for describing and analysis the system and information showing ignorance. In practical terms it means that as to understood complex system, it is necessary to search for representative variables. This observation is well-known but with exposing the sense of complexity as a representation of ignorance, it may be analytically and heuristically valuable.
2. In any discussion on complexity, it is necessary to define what kind of complexity is discussed. What are the characteristics of complexity – formal models, metaphors, analogies? In numerous examples, the authors applying complexity jargon in social systems analysis do not pay sufficient attention, or do not pay any attention at all, to the meaning of complexity.
3. The new interpretation of complexity allows to conclude that awareness of incomprehensibility (ignorance) has a strong emotional conscious and unconscious appeal. The utterance: "This is complex and I (we) can help you in comprehending and influencing it" contributes to creation of markets of "complexity studies", "complexity science" treated in a rigorous way. Complexity as awareness of incomprehensibility can be used as a point of departure of operationalization and quantification. Information overabundance could be helpful in better defining the degree of ignorance referring to normative states determined by information needs. The idea of complexity presented in the paper will be developed in several directions and one of most important ones is the elaboration of measurable indicators of ignorance-determined complexity.
4. Survey of literature shows that the number of works referring to more or less precisely defined complexity is growing rapidly. Some of the authors use the term complexity theory and/or complexity science. These terms are likely going too far. Perhaps they are justifiable for narrowly defined "hard" complexity but they are not justifiable when referred to

qualitative considerations on complexity (“soft” complexity) often depicted with loosely defined analogies and metaphors. Looking from the point of view of development of scientific theory, the studies of complexity are lagging behind the patterns of a mature theory. Therefore in this paper only the term complexity studies is applied.

3. Paradoxes and social complexity

The first studies of significance of the paradoxes in management appeared in the world literature in the 80s of the twentieth century, e.g. (Putnam 1986; Quinn, & Cameron 1988). Special importance for the study of the meaning of paradox in management have the works of Lewis (2000) and [Smith, & Lewis 2011]. The authors note that the term "paradox" has become an important element of the theory and practice of management. It is quite obvious observation, as appropriate, each complex social phenomenon, including organizations also created by humans possess characteristics that can be described as paradoxical. This follows from the very nature of human perception of reality. This is reflected in the already mentioned in the definition of information proposed by Bateson (1972: 453): "Information is the difference that makes the difference

For the purpose of analyzing the role of the paradoxes in management Lewis [2000] takes as a point of departure the definition proposed by Ford & Backoff [1988: 89]: Paradox: some 'thing' that is constructed by individuals when oppositional tendencies are brought into recognizable proximity through reflection or interaction”.

Ford & Backoff's definition, offers a possibility to identify three overarching characteristics of paradox [Lewis 2000, p. 761]. First, as some 'thing,' a paradox may denote a wide variety of contradictory yet interwoven elements: perspectives, feelings, messages, demands, identities, interests, or practices. Second, paradoxes are constructed. As actors attempt to make sense of an increasingly intricate, ambiguous, and ever-changing world, they frequently simplify reality into polarized either/or distinctions that conceal complex interrelationships. Third, paradoxes become apparent through self- or social reflection or interaction that reveals the seemingly absurd and irrational coexistence of opposites.

The question is very broad but a rank of preliminary answers can be provided. The answers are somehow simpler, when the problems of defining complexity, and the links between complexity of social systema and awareness of incomprehensibility are borne in mind.

TABLE 1

Fundamental paradoxes of complexity of social system

Objects of study	Feature	Opposite feature
Organization	**objective**	**subjective**
	objective	**intersubjective**
	subjective	**intersubjective**
	Organization (social system) – elements + relations (tangible and intangible)	**Organization (social system) – system of meaningful communication (Luhmann, 1997)**
Complexity	**Objective (number of elements, relations between elements, feedback), nonlinear relations (all characteristics can be operationalized and modelled)**	**Subjective (intersubjective) (complexity as a result of the of object-observer relation - "complexity is always in the eye of the beholder")**
Change of social systems	**Organization changes are partly predictable with the use of mathematical models**	**Changes studied with the constructivist approach (mathematical models + narratives)**
	Synergy possible to describe using mathematical models, e.g. with complex adaptive systems (emerging properties)	**Synergy as a metaphor (subjective and intersubjective approach)**
Observer/participant/author	**External, non-reflexive**	**Internal, exposed to individual and social reflexivity, self-reflexivity and self-reference**

The above table stirs several questions. Firstly, the complexity of paradoxes. In many instances they also can be treated as nested complex problems. Following this line of reasoning we may fall into and infinite recurrent analysis which would be just vain. Thus the second question is arising: What are the limits of applying sophisticated methods of description and analysis of

organization? Two aspects have to be taken into account: limits of narratives and limits of mathematical modelling.

4. Complexity, security and paradoxes: An initial overview

4.1. The Grand Visions – complexity as the source of global crises

It can be observed that the titles of writings including such notions as chaos, edge of chaos, complexity, turbulence, etc., draw additional attention of non-specialists in the field, among social scientists who do not have a sufficient background in mathematical aspects of those terms, and last but not least, among the general public. This extra 'appeal' of the works with titles and narratives embodying those utterances is likely one of the reasons of simplifications, misuses and abuses.

This observation is perfectly correct when the Grand Visions of complex large-scale social systems developed in already mentioned works - as, for example, the risk society of Beck [1992], complexity-stimulated crises discussed by Tainter [1988, 2000], Diamond [1997, 2005], ingenuity gap of Homer-Dixon [2002]. In all those works the main idea is that with increasing complexity social systems collapse because of inability of the rulers and the societies to cope with the consequences of that complexity. Several important questions are thus arising:

A. What are the definitions of complexity?
B. To what extent the authors take into account the "soft" complexity of social systems?
C. How the increasing amount of information, whatever its definitions may be, are considered in the pessimistic visions of exhaustive complexity leading to crises?
D. To what extent the actors (stakeholders) participating in the large scale societal systems are aware of their complexity and of the limitations of operationalizations and control – in any form (traditional and supportive of self-organization).

Preliminary answers to the above questions lead to the main conclusion that in all above cases, perhaps with an exception of the works by Homer-Dixon, the ideas of complexity are applied as crude metaphors, relating to the tangible attributes of the societal systems. In such case all problems deriving from intersubjectivity and "soft" complexity lead to multitude of challenges which are of a special importance in the modern society in which "hard" complexity is just insufficient.

4.2. The quadrangle of complexity and security

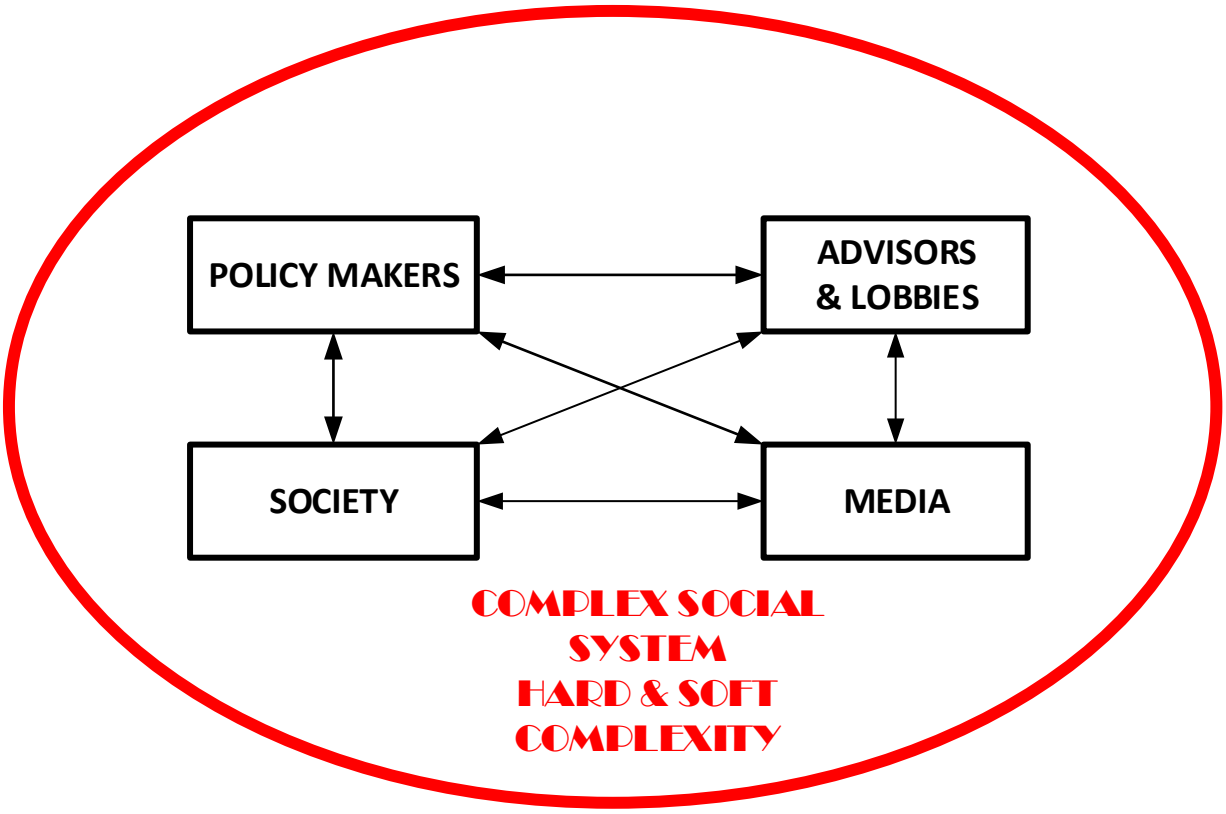

Figure 1. The quadrangle of paradoxes of complexity and security

Taking into account the previous considerations on insufficiency of understanding of complexity of modern social systems, as well as awareness of limited understanding of the modern society with information overabundance, a rank of questions are arising. Those questions are of a special importance since the contemporary security theory and policy seems to be incapable in helping to understand the processes in the modern social systems. In the past the leading schools of security theory tended to apply a neopositivist approach based upon formal models, cybernetics (first and second order), simulation, etc. At present the picture is more opaque due to the impact of constructivism, post-modernism, psychological approaches, linguistics. This situation sets new limits on mathematization and verbal studies, which have to be known when doing research on modern complex social systems. It should added that the above challenges are emerging not only in social sciences but also in economics and finance.

The above scheme and preliminary reasoning may be helpful in a better understanding of the following challenges of the modern security theory and policy.

First, how the awareness of complexity of modern society is transmitted to the main social actors, especially policy makers and their advisors (scholarly community, civilian and military think-tanks, etc?

Secondly, do the policy makers are aware of the consequences of complexity of the modern world resulting in limited predictability, counterproductiveness of decisions?

Third, are the politicians and advisors are aware that modern science is not sufficient in provide applicable policy recommendations at all levels of the societal hierarchy?

5. Conclusions

The main question of the study concerned the meaning of the term complexity under the conditions of information overabundance embodying information explosion and information overflow which are affecting the society at all levels of hierarchy. A very detailed survey of literature on complexity, information overabundance allowed for elaborating a new definition of complexity of social systems which is connected with the new and forthcoming phenomena concerning information creation and processing. This definition exposes the role of increasing awareness of social actors of incomprehensibility of social phenomena. The new definition of complexity of social systems allows for better ordered discourse on the meaning of this utterance. The survey allowed to formulate several conclusions and at the same time the directions for further research.

1. Increasing complexity of social systems sets new limits upon development of sophisticated narratives and mathematical modelling of complex social systems.
2. Development of security theory studies should be based upon more advanced models of social systems including awareness of reflexivity, intersubjective character of social systems and knowledge of new sense of complexity including cognitive mechanisms.

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