Uncertainty and certainty property estimation of organizational-economic system

Kuzmin, E. A.

Ural State University of Economics

March 2012

UNCERTAINTY AND CERTAINTY PROPERTY ESTIMATION OF ORGANIZATIONAL-ECONOMIC SYSTEM *

Kuzmin Evgeny Anatolievich

Ural State University of Economics

E-mail: KuzminEA@gmail.com

Summary. Uncertainty as a self-condition of open stochastic system is a principium of development of risk representations and their influences on organizational-economic subjects and objects. Undoubtedly, taking any management decisions is followed by uncertainty influence. This circumstance absolutely logically turns this category into central concept of management theory in various fields of knowledge.

In this article the author deeply inquires into a question of uncertainty and certainty property estimation in organizational-economic system, gives and proves an author's opinion at the uncertainty nature and approaches to its calculation that is accompanied with studying of back property toward uncertainty – certainty of organizational-economic system. The author puts forward and reasonably proves a model of uncertainty cycle and calculation methods of cumulative uncertainty and certainty.

Keywords: organizational-economic systems, uncertainty, certainty, self-organizing, uncertainty types, model of uncertainty cycle.

* – The research has been done with the financial support of the Russian Foundation for Research in Human Sciences (RHSF), project № 11-12-66006а/У.

Uncertainty, being a measure of information, is objectively connected with the entropy concept represented as an analysis of information completeness and quality.[1] Evolution of uncertainty representations was directly reflected on formula manipulation of its calculation. Researches of Claude Elwood Shannon[2] and Léon Nicolas Brillouin[3] have brought the considerable contribution to formalization of information entropy calculation. Their positions were similar to the researches of uncertainty in physical systems of Wainwright J.T. (Jacob Tripler)[4], Magie W.F[5]. And Clausius R.[6], who firstly introduced a concept that was characterized as an approached value of entropy and it was defined as «equivalent cost».

Later Clausius R.[7] formulated a complete definition of entropy as a measure of the disorder of a system. As he marks, the name of the concept of entropy is similar to «energy». Clausius R. defines this similarity as a close connection of these concepts [in a physical sense]; consequently their similar names are seemed to be reasonable to them.

Analyzing in this research uncertainty in complex organizational-economic systems, the author focuses on existence of the symmetric phenomenon toward entropy – negentropy. The term «negentropy» has appeared at the statistical treatment of entropy in the research of Boltzmann L.[8], who used the term «negative entropy».

---

[1] Note: the information is understood by the author as some data set structured in such a way that it has some sense for subjective communication.

[2] Shannon C.E. A Mathematical Theory of Communication //The Bell System Technical Journal, Vol. 27, № 3, 1948. – pp. 379-423

[3] Brillouin L. Science and information theory. – M.: State Publishing House of Physical and Mathematical Literature, 1960- p. 391.

[4] Wainwright J.T. (Jacob Tripler) An investigation of the second law of thermodynamics. – Chicago, 1913. – 28 p. – p. 10

[5] Magie W.F. The second law of thermodynamics; memoirs by Carnot, Clausius, and Thomson. Tr. and ed. by W.F. Magie/ – New York, London, Harper & brothers, 1899. – 151 p.

[6] Clausius R. Published in Poggendoff's Annalen, Dec. 1854, vol. xciii. p. 481; translated in the Journal de Mathematiques, vol. xx. Paris, 1855, and in the Philosophical Magazine, August 1856, s. 4. vol. xii, p. 81; Clausius R. On the Application of the Mechanical theory of Heat to the Steam-Engine. (1856) as found in: Clausius, R. (1865). The Mechanical Theory of Heat – with its Applications to the Steam Engine and to Physical Properties of Bodies. London: John van Voorst, 1 Paternoster Row. MDCCCLXVII.

[7] Laidler K.J. The Physical World of Chemistry. Oxford University Press, 1995. – pp. 104–105; OED, Second Edition, 1989, Clausius (Pogg. Ann. CXXV. 390), assuming (unhistorically) the etymological sense of energy to be «work-contents» (werk-inhalt), devised the term entropy as a corresponding designation for the «transformation-contents» (verwandlungsinhalt) of a system

[8] Boltzmann L. The Second Law of Thermodynamics (1886). In B. McGinness, ed., Ludwig Boltzmann: Theoretical physics and Philosophical Problems: Selected Writings. Dordrecht, Netherlands: D. Reidel, 1974. – p. 14-32

The abbreviated name of negentropy is connected with the research of Schrödinger E.[9] of the physical phenomena in the nature, making a point that «life feeds on negative entropy».

The author considers the use of negentropy for stability assessments and controllability of organizational-economic system to be quite logical and proved. Perceiving negentropy both the force and characteristic of organization or self-organizing of social and economic system, it may be concluded that it is negentropy, which should be «operator» of controllability of processes. Marking inversely proportional connection of entropy and negentropy, the author offers and scientifically proves the original methodological approach to the uncertainty estimation, analysis and management through the negentropy parameter, typical for any organizational-economic system.

The possibility of using the negentropy in risk management for government-private partnership as a special case of organizational-economic system is proved by the research of Grinberg S.M.[10], which states the idea that « in risk management, negentropy is the force that seeks to achieve effective organizational behavior and capable to lead to a steady predictable state [both for state and state and private business]». It is necessary to add to this the conclusion of Tihomirova N.P. and Tihomirovoj T.M.[11], concerning uncertainty influence on risks management and adequacy of their estimations which indirectly gives confirmation to the assumption of the author of uncertainty influence for the change of risks importance for organizational-economic system. The researchers (Tihomirov N.P. and Tikhomirov T.M) mark that «uncertainty directly affects (reduces) accuracy of risk estimations and assurance of following conclusions and decisions taken on operations management of object in a risky condition».

Taking into account that uncertainty accepts different kinds and types the author simplifies the process of uncertainty classification to aggregate various kinds of

---

[9] Schrödinger E. What is Life? (ch. 6 «Order, Disorder, and Entropy»). – Cambridge: Cambridge University Press, 1944. – p. 67-75

[10] Grinberg S.M. Pedagogical risk and governmentality: shantytowns in Argentina in the 21st century. – SCARR: Social Contexts and Responses to Risk, Queens' College, Cambridge: Risk & Rationalities Conference, 2007 - p. 4

[11] Tikhomirov N. P., Tikhomirova T. M. Risk Analysis in Economy: Monograph. – M: Economy, 2010. – p. 318. – p. 138

uncertainty refering to one impact area on organizational-economic system that in turn will allow to structure uncertainty estimations. By that the author mentions 4 types of uncertainty for which with a view of this research it is possible to estimate the uncertainty level, expressed through entropy and negentropy, becoming basic criterion of organizational-economic system stability and controllability.

In uncertainty typification the author is based on the classification, offered by Avdijsky V.I. and Bezdenezhnih V.M.[12], who selects uncertainty of the 1st, 2nd, 3rd types. Environmental uncertainty [external environment] refers to uncertainty of the 1st type, a choice of taking management decisions - uncertainty of the 2nd type, the future realization of management decisions - uncertainty of the 3rd type. As Avdijsky V.I. and Bezdenezhnih V.M. mark that uncertainty of the 2nd and the 3rd types is self-organizing system indicator. However, according to the author, this kind of classification needs explanation as in the research of Avdijsky V.I. and Bezdenezhnih V.M. the process of "creation" or uncertainty generation is considered only in a linear view, that means the beginning and the end of uncertainty chain is marked. The author reviews this process as a cyclic one, therefore a new type of uncertainty appears after the first cycle is completed – vartatsion uncertainty of the 4th type (change of conditions and system restrictions). This uncertainty changes the state of the environment, creating new quasiconditions which are a consequence of variative realization of taken management decisions. The new cycle starts with uncertainty of the environment obtaining distinctive characteristic from its condition on the previous cycle, due to uncertainty participation of internal and external factors. (Figure 1).

[12] Avdijsky V.I. and Bezdenezhnih V.M. Uncertainty, variability and contradictoriness of risk analysis problems of economic system behavior //Effective anti-recessionary management. 2011, № 3 (66). p. 46-61. – p. 54

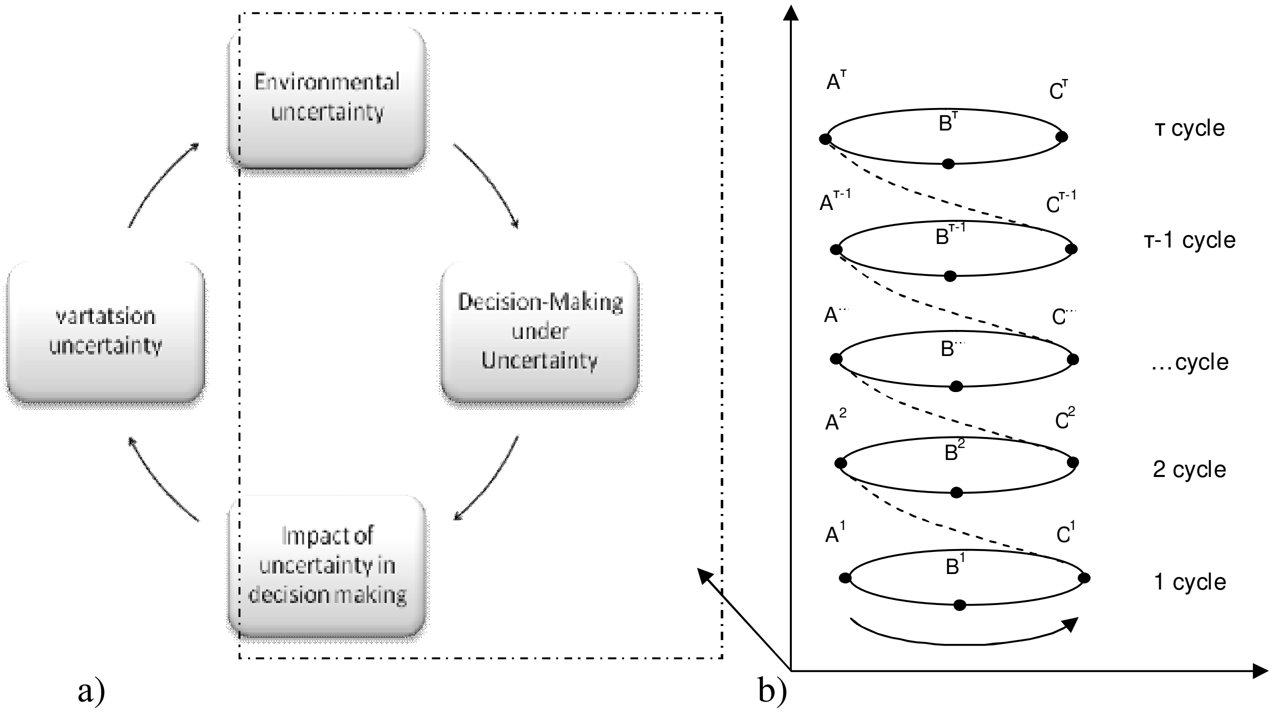

Figure 1 – Model of uncertainty cycle of organizational-economic system for one of the activities[13]

References:

Figure a)

A^T – Environmental uncertainty (1 st type)

B^T – Decision-Making under Uncertainty (2 st type)

C^T – Impact of uncertainty in decision making and their future realization(3 st type)

-- – Vartatsion uncertainty (4 st type)

Figure b)

– One cycle system uncertainty

The author's model of uncertainty cycle clearly shows dynamic process and transformation of organizational-economic system uncertainty where initial movement of uncertainty starts with environmental uncertainty and comes to an end with vartatsion system uncertainty. Therefore the system enters a new condition. Graphic model representation doesn't cover all areas of activity of the subject of organizational-economic system and consequently it is presented in an extremely

[13] Made by author.

ordinary way. Also in the model of uncertainty cycle the first cycle is not established as an obligatory one. For complex systems, having existed for a long time, the specification of the first cycle can't be possible, so the visual model is made for complex organizational-economic systems that have just begun their functioning. The state-private partnership where there are accurate terms of beginning and end of projects realization can be taken as an example of this kind of system.

The author's representations expressed in the model of uncertainty cycle are fully corresponded to the theory positions of ECLET («Emergent Cyclical Levels of Existence Theory»). The founder of this theory is Clare W. Graves[14]. Theory ECLET was developed from theoretical point of view and empirical researches of Clare W. Graves about spiral human development. The concept « Spiral Dynamics » was introduced by Beck D.E., Cowan C.C.[15], followers of Clare W. Graves's ideas, who later defined the existence of ECLET theory.

With reference to organizational-economic systems ECLET theory means, according to Marrewijk van M.[16] that « All entities – including organizations – will eventually have to meet the challenges their context provides or risk the danger of oblivion or even extinction». Similar response is based on «a certain set of values of assumption and indicators» where the development of value systems occurs in a fixed order. Each new value system concerning adherence conditions to values «includes and transcends the previous ones, thus forming a natural hierarchy (or holarchy)». [holarchy – the concept for reflection «holons» – where holon is both a whole and a part of hierarchy forms[17]].

According to the author, it is possible to designate holarchy as vartatsion uncertainty which is simultaneously included into a single uncertainty cycle and situated in an isolated condition. The similar uncertainty type is the only one which

[14] Graves, Clare W. Levels of Existence: An Open System Theory of Values // The Journal of Humanistic Psychology, Fall 1970, Vol. 10. No. 2, pp. 131–154

[15] Beck D.E., Cowan C.C. Spiral dynamics: mastering values, leadership, and change: exploring the new science of memetics. – John Wiley & Sons, 1996. – p. 331

[16] Marrewijk van M. A Value Based Approach to Organization Types: Towards a Coherent Set of Stakeholder-Oriented Management Tools // Journal of Business Ethics, Vol. 55, № 2, Social Dimensions of Organizational Excellence (EFQM-EOQ Convention 2003), 2004. – pp. 147-158

[17] The note: the concept «holarchy» was introduced by Koestler A. in 1967 (Koestler A. The ghost in the machine. – Macmillan, 1967. – p. 384)

reflects perspective conditional uncertainty of the system, whereas decision-making under uncertainty and the consequences of taken decisions are based on environmental uncertainty. Simultaneously with this, the author notices that the model of uncertainty cycle doesn't imply uncertainty increase or decrease at the growth in due course of "complexity" of organizational-economic system. The proposal of growth of direct proportionality of system uncertainty growth with growth of complexity, stated by a number of scientists, according to the author, can't be reasonably true. As system complexity can be compensated by structuring and variety of system elements – by filtration. These are not the only ways of uncertainty change of complex organizational-economic system, but a number of preventive management measures are based just on them[18], which later will be defined as tools for uncertainty management which are based on estimations of each element of general system uncertainty.

Coming back to model structuring of uncertainty estimation for complex organizational-economic system, the author hypothesizes about the necessity of cumulative account of uncertainty of any type, where environmental uncertainty, a choice of management decisions and the future realization of these decisions are independent components of general system uncertainty and accompanied with vartatsion uncertainty. In this case, vartatsion uncertainty is reviewed as a calculation error and expresses possible change of system algorithm, its restrictions and internal, logic, cause and effect processes.

The formalized cumulative uncertainty expression of the complex organizational-economic system, reflecting aggregate uncertainty for particular spatiotemporal moment, according to the author, can be expressed in the following way with use of both absolute and relative estimations:

[18] The note: the paradoxicality of the concept « uncertainty management », used by the author, assumes the subject of organizational-economic system that can and should affect not only risks of a system, but also its uncertainty for the purpose of increase of system stability and controllability as a whole. The essence and nature of uncertainty doesn't include its management possibility. However, the author advances an idea on possibility of conditional management of a number of events and phenomenon which can be presented in the form of preventive influence measures.

$$H_b(S) = [H_{ee} \times k_{ee} + H_{md} \times k_{md} + H_{cd} \times k_{cd}] + H_v \times k_v,$$

$$\text{with } \sum k = 1 \text{ and } H > 0,$$

$$k_{ee} = \frac{H_{ee}}{\sum (H_{ee} + H_{md} + H_{cd} + H_v)},$$

$$k_{md} = \frac{H_{md}}{\sum (H_{ee} + H_{md} + H_{cd} + H_v)},$$

$$k_{cd} = \frac{H_{cd}}{\sum (H_{ee} + H_{md} + H_{cd} + H_v)},$$

$$k_v = \frac{H_v}{\sum (H_{ee} + H_{md} + H_{cd} + H_v)},$$

where

$H_b(S)$ – cumulative uncertainty of the complex organizational-economic system;

H_{ee} – environmental uncertainty (external environment);

k_{ee} – participation coefficient of environmental uncertainty in development and evolution of organizational-economic system;

H_{md} –uncertainty of management decisions choice;

k_{md} – participation coefficient of uncertainty of management decisions choice in development and evolution of organizational-economic system;

H_{cd} – uncertainty of consequences of decisions and future realization of management decisions;

k_{cd} – participation coefficient of uncertainty consequences of decisions and future realization of management decisions in development and evolution of organizational-economic system;

H_v – vartatsion uncertainty;

k_v – participation coefficient of vartatsion uncertainty in development and evolution of organizational-economic systems.

The author emphasizes restrictions of the use of the approach to estimation of cumulative system uncertainty. The basic restriction of the use of suggested approach is proportionality of information quantity (quantity of an individual signal between elements – subjects of organizational-economic system), which is considered in uncertainty calculation in a general view.

In addition, as the author has already noted, uncertainty estimation can be made in absolute and relative calculation. In the general case, uncertainty of each component of cumulative uncertainty of organizational-economic system is calculated with use of formula, offered by Shannon C.E.[19], at the moment being standard and irrefutable in estimations of system entropy.

Calculation according to Shannon C.E. lets estimate b-ary entropy, the entropy reflecting b-ary information quantity. It is the basic condition for the use of formula of cumulative calculation of system uncertainty, where proportionality of information quantity, transmitted in one signal from one element (of a subject) of a system to another, should be kept. Shannon C.E. also notices that b-ary entropy calculation is made for systems with discrete probability (frequencies) distribution that means for systems where the composite probability of case occurrence makes a unit.

Inclusion a probability (frequency) into uncertainty estimation can lead to duality and discrepancy of sights to risk estimation as at their estimation there is a parameter of a possibility measure of event occurrence. The difference between uncertainty estimations and risk estimation consists in measured object: in risk estimation the object of an analysis is events which can appear with some frequency; in uncertainty estimation the object of research is information. This distinctive feature in risk and uncertainty estimation lets use probability as universal parameter of finding the casual phenomena and events.

Exclusiveness of possibility of the use of probability in uncertainty estimation is used in researches of Mosleh A., Bier V. M., Apostolakis, G.[20], Winkler R.L.[21],

---

[19] Shannon C.E. A Mathematical Theory of Communication //The Bell System Technical Journal, Vol. 27, № 3, 1948. – pp. 379-423. – p. 393

[20] Mosleh A., Bier V. M., Apostolakis, G. A critique of current practice for the use of expert opinions in probabilistics risk assessment. Reliability Engineering and system safety, 20, 1988. – P. 63-85

[21] Winkler R.L. Uncertainty in probabilistic risk assessment. Reliability Engineering and system safety, 54, 1996. – p. 127-132.

O'Hagan A., Oakley J.E.[22], who emphasize that probability is the only way of uncertainty representation irrespective of practical difficulties. Shannon C.E. uses probability as the basic indicator characterizing uncertainty, subordinated to special distribution. The entropy formula of Shannon C.E. originally estimates uncertainty in absolute calculation and can be presented as:

(2)

$$H = -\sum_{i=1}^{n} p_i \times \log_b p_i \ ,$$

$$H_i = -p_i \times \log_b p_i$$

$$\text{with, } p_i \neq 0, \ \sum_{i=1}^{n} p_i = 1 \rightarrow H > 0$$

where

H – entropy (uncertainty) of j-value;

H_i – entropy (uncertainty) i-type event or phenomena in j-value;

p_i – probability (frequency);

b – signal size (quantity of individual information), b>1;

n – number of variants.

According to Shannon C.E., entropy estimation assumes that its minimum value is defined by a possible limit, when the probability (frequency) of any variant occurrence will be approached to zero. In this case the maximum (top) border of uncertainty will depend on the signal size and number of possible variants, which probability is not equal to zero. The objective proof of this is calculation of the limit of uncertainty function according to Shannon C.E.:

(3)

$$\lim_{p \to 0+} p \times \log_b p = 0$$

[22] O'Hagan A., Oakley J. E. Probability is perfect, but we can't elicit it perfectly. Reliability Engineering and system safety, 85, 2004. – p. 239-248

Reviewing of uncertainty estimation through an entropy indicator is extremely significant for understanding the research logic in negentropy estimation and its expressions. Accepting entropy and negentropy as symmetric characteristics of the information stream referring to one organizational-economic system, the author states to that negentropy should be expressed with the use of entropy estimation observing constant balance of the sum of entropy and negentropy.

It is necessary to specify here that a number of both foreign and local scientists come to perception of negentropy and its calculation in absolutely different ways. So, it is possible to emphasize the point of view of Brilluien L.[23] who defines negentropy as negative entropy and explains it comparing the changes of entropy and negentropy with bound information. In his opinion, it is possible to define this position « Negentropy Principle of Information » that can be presented in the form of mathematical identity at new bound information:

(4)

bound information = decrease in entropy = increase in negentropy.

By analogy of formula calculation of cumulative uncertainty (entropy) of organizational-economic system (1), and also the derived identity of negentropy estimation, it is possible to express cumulative value of controllability and stability degree of organizational-economic system as a set of negentropies, common for uncertainty conditions of the 1st, 2nd, 3rd and 4th types:

(5)

$$HE_b(S) = \left[HE_{ee} \times \hat{k}_{ee} + HE_{md} \times \hat{k}_{md} + HE_{cd} \times \hat{k}_{cd}\right] + HE_v \times \hat{k}_v ,$$

$$\text{with } \sum \hat{k} = 1 \text{ and } HE > 0 ,$$

$$HE_{ee} = \log_b n_{ee} + \sum_{i=1}^{n_{ee}} p_i \times \log_b p_i , \; HE_{md} = \log_b n_{md} + \sum_{i=1}^{n_{md}} p_i \times \log_b p_i ,$$

$$HE_{cd} = \log_b n_{cd} + \sum_{i=1}^{n_{cd}} p_i \times \log_b p_i , \; HE_v = \log_b n_v + \sum_{i=1}^{n_v} p_i \times \log_b p_i ,$$

[23] Brillouin L. Science and information theory. – M.: State Publishing House of Physical and Mathematical Literature, 1960- p. 391. – p.201

$$\hat{k}_{ee} = \frac{HE_{ee}}{\sum(HE_{ee} + HE_{md} + HE_{cd} + HE_{v})}, \ \hat{k}_{md} = \frac{HE_{md}}{\sum(HE_{ee} + HE_{md} + HE_{cd} + HE_{v})},$$

$$\hat{k}_{cd} = \frac{HE_{cd}}{\sum(HE_{ee} + HE_{md} + HE_{cd} + HE_{v})}, \ \hat{k}_{v} = \frac{HE_{v}}{\sum(HE_{ee} + HE_{md} + HE_{cd} + HE_{v})},$$

where

$HE_b(S)$ – cumulative negentropy of organizational-economic system;

HE_{ee} – environmental negentropy (external environment);

$\hat{k}_{ee}$ – participation coefficient of environmental negentropy in development and evolution of organizational-economic system;

HE_{md} – negentropy of management decisions choice;

$\hat{k}_{md}$ – participation coefficient of negentropy of management decisions choice in development and evolution of organizational-economic system;

HE_{cd} – negentropy of consequences of decisions and future realization of management decisions;

$\hat{k}_{cd}$ – participation coefficient of negentropy of consequences of decisions and future realization of management decisions in development and evolution of organizational-economic system;

HE_{v} – vartatsion negentropy;

$\hat{k}_{v}$ – participation coefficient of vartatsion negentropy in development and evolution of organizational-economic system.

According to Brilluien L., the principle (4) is an obvious consequence from system dynamics in two various conditions: when the initial condition corresponds to zero uncertainty, and its final condition of uncertainty is more than zero. In this case, according to uncertainty expression through a natural logarithm, Brilluien L. defined system difference in its two conditions:

$$H_1 - H_0 = LnP_0 - LnP_1 \tag{6}$$

Similar estimations and understanding of entropy and negentropy was the subject to criticism as the formulations of Brilluien L. say that information is expressed through negative entropy that contradicts logic understanding of constant balance of information and entropy. But here Brilluien L. doesn't say that information is expressed through negative quantities. He noticed that only negentropy is expressed through negative quantities and only toward entropy. Besides Brilluien L. has made the exact statement that « Entropy measures lack of information»[24]. It is important to notice that the researches of Shannon C.E. were ere the subject of criticism and important additions and remarks of other scientists, but remaining the base to uncertainty estimation in many fields of knowledge.

Existence of constant balance of the information and entropy is noted in the research of Prangishvili I.V.[25] In his research Prangishvili I.V. expressed his point of view: «the total quantity of the information and entropy of j-value of space or its corresponding area, appearing in the result of any process, is always constant», focusing that it is a well known fact:

$$\sum_{j=1}^{\infty} I_j + \sum_{j=1}^{\infty} H_j = const \tag{7}$$

where

I_j – j-value information ;

j – the same j-value (process), for which both information and entropy quantity is measured.

However, the author considers that it isn't quite explained, as entropy and negentropy are direct measures of information and can't be components of its constant balance. It is necessary to mention that the information by its nature is subjective and its value, and also its quality, with time can change, as well as truth criterion of information.

---

[24] Brillouin L. Science and information theory, State Release of Physical – Mathematical literature., New York, 1960- p. 391. – p.211

[25] Prangishvili I.V. Entropy and other system laws: Control Problems of Complex Systems / Prangishvili I.V.; Management Research Institute named after Trapeznikova V.A.. – M.: Science, 2003. – p. 428.

Therefore the author reasonably assumes that the total quantity of entropy and negentropy for organizational-economic system will make a conditional constant of the information balance. The convention of constant balance is caused by the subjective nature of the information and consequently in ideal static conditions this balance can be called as a rough balance. Mathematical representation of this balance can be expressed in the following way:

$$\sum_{j=1}^{\infty} H_j + \sum_{j=1}^{\infty} HE_j = const \qquad (8)$$

where

HE_j – negentropy of j-value.

Graphic representation of author's aspect at the constant balance process can be presented as entropy and negentropy relationship under the influence of information streams (Figure 2).

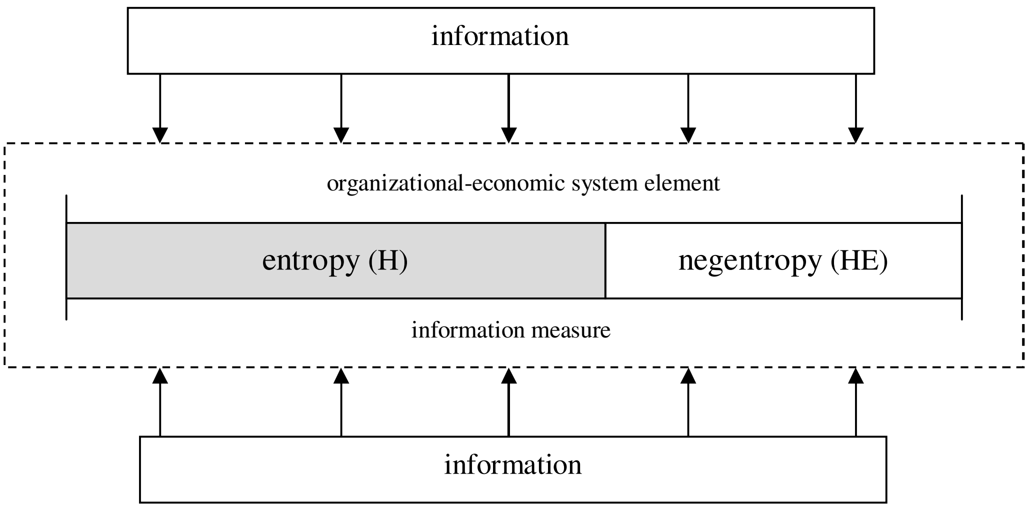

Figure 2 – The mechanism of constant balance formation in organizational-economic system element[26]

[26] Made by author

Thus, in constant balance, the information acts as "weighing scales" between entropy and negentropy of organizational-economic system, displacing it in a more operated condition with obtaining additional information (with an adequacy criteria and data actuality) and in a less operated condition in cases, when:

1) information is lost;

2) information doesn't pass a verification process, which means it is inadequate and inaccurate – information quality shows that information obtains a misinformation form;

3) quantity of objective true information of a system has changed with time (increased) to the level that current data point to the fact that organizational-economic system is not operated.

The second characteristic of system in the form of stability also undergoes transformation. The increase in negentropy indicates the approach to a condition of full stability, and at increase in entropy this condition tends to elements' dysfunctionality of organizational-economic system.

Both controllability and stability of organizational-economic system are important indicators of cumulative risk-profile where the behavior of economic agents can be predestined with uncertainty value for system. Tending to maximization of utility the behavior of the economic agent, at maximum negentropy value, can be much more risk-attached compared to a less negentropy value. It is explained by «safety factor» of entropy or negentropy change and by existence of a limiting level of insuperable negentropy level (and entropy as well).

In this connection, the author hypothesizes that the constant can have an obvious measure. Being based on logical position that entropy has a maximum in the equiprobable cases, mentioned in research of Brilluien L.[27], the author assumes approximation of entropy maximum to constant, as entropy can have values more than zero and not equal to zero. Approximation of an estimation is based on the fact

[27] Brillouin L. Science and information theory. – M.: State Publishing House of Physical and Mathematical Literature, 1960- p. 391. – p.203

that the change range of entropy value is (0; ∞ +). Thus, the constant for the certain moment of spatiotemporal measurement can be found in the following way:

(9)

$$const \approx -n \times \log_b \frac{1}{n} \to \max H \ ,$$

or

$$const \approx \log_b n \to \max H \ .$$

Using the received expression of finding entropy maximum it is possible to estimate negentropy in author's vision, that negentropy acts as symmetric entropy value. The author underlines that this statement contradicts the stated theoretical sights of scientists by definition of negentropy as differences between system conditions, which is indirectly proved in research of Brilluien L., when the initial system condition is found in a zero point, thus the possibility of finding negentropy through maximum entropy value isn't excluded. In physical systems the similar approach is found in researches of Planes A., Vives E.[28], Hens Z.[29], which points to the reasonable author's assumptions.

That way, in a general case, according to the author, negentropy can be explained on the basis of following mathematical identity:

(10)

$$HE = \log_b n + \sum_{i=1}^{n} p_i \times \log_b p_i$$

where

HE – negentropy of j-value.

(11)

$$HE_i = \frac{\log_b n}{n} - H_i = \frac{\log_b n}{n} + p_i \times \log_b p_i$$

where

[28] Planes A., Vives E. Entropic Formulation of Statistical Mechanics, Entropic variables and Massieu-Planck functions Universitat de Barcelona, 2000.
[29] Hens Z. Hemptinne de X. Non-equilibrium Thermodynamics approach to Transport Processes in Gas Mixtures, Department of Chemistry, Catholic University of Leuven, Celestijnenlaan 200 F, B-3001 Heverlee, Belgium

HE_i – negentropy of i-type event or phenomena in j-value;

The change range of negentropy value of j-value is directly depends on constant balance value and entropy in j-value. Considering that entropy can accept all possible intervals (0; ∞ +) it is fair to assume that negentropy will be in this interval as well. Thereby, for j-value both entropy and negentropy accept positive values. Entropy and negentropy values for i-type event or phenomena of organizational-economic system in j-value change in absolutely different way. The author managed to find antinomical property of negentropy from the formula (11), which in certain situations can be negative. This property develops, when the probability of i-type event exceeds probability value of equiprobable event, that is $p_i > 1/n$. In that case antinomical property of entropy comes up, characterized by uncertainty of event with higher probability in comparison with equal probability, can be more than at an equiprobable outcome. In other words, the high probability or frequency of event or phenomenon doesn't directly mean that uncertainty toward it will be lower, than at less probability of an outcome. This has led the author to the conclusion that the equiprobable outcome allows to reach the maximum entropy only for a j-value of organizational-economic system from the formula (2) and can't be applied to calculation of maximum uncertainty value for i-type event or phenomena.

Thus, negentropy of i-type event or phenomena of organizational-economic system can be both negative and positive, unlike entropy (uncertainty) values that is in positive area. Antinomical property of negentropy events or phenomena let the author find the approximate interval of its value changes in a range:

(11.1)

$$p \times \log_b p < HE_i < -p \times \log_b p$$

with $p = \frac{1}{e}$

or

$$\frac{1}{e} \times \log_b \frac{1}{e} < HE_i < -\frac{1}{e} \times \log_b \frac{1}{e}$$

where

e – Napierian logarithm.

On one side the set value range points to finding maximum entropy value, which according to the formula (11.1) is reached at probability equal to inverse value of Napierian logarithm. This consequence about maximum uncertainty value of i-type event or phenomena will become the basis of the following entropy and negentropy research at formation of acceptable value levels.

The author's view for certainty (negentropy) doesn't suppose using Napierian logarithm probability in estimation and calculation of negentropy for events or phenomena of organizational-economic system. This is based on possible constant balance upset which can occur in a case when equiprobable event will be replaced with the event with maximum uncertainty (entropy). In author's interpretation calculation of negentropy of events and phenomena of organizational-economic system assumes transition to negentropy calculation of j-view that wouldn't be possible while using Napierian logarithm probability. Therefore the author's position in this point consists in separate uncertainty and certainty analysis for both events or phenomena, and organizational-economic system as a whole, and for a j-view.

In this article the author's approach to calculation of the general and cumulative values of uncertainty (entropy) and certainty (negentropy) is represented and scientifically proven. This approach solves a number of challenges of an estimation of cumulative quantity of uncertainty of organizational-economic in the most appropriate way. Besides, the author gives their individual estimations for system as a whole and for events or phenomena of organizational-economic system. So, the author's approach to perception of uncertainty and certainty of organizational-economic system as its integral properties make possible to deepen and expand theoretic-methodological base of research.

Referencies

1. Avdijsky V.I. and Bezdenezhnih V.M. Uncertainty, variability and contradictoriness of risk analysis problems of economic system behavior //Effective anti-recessionary management. 2011, № 3 (66).
2. Beck D.E., Cowan C.C. Spiral dynamics: mastering values, leadership, and change: exploring the new science of memetics. – John Wiley & Sons, 1996.
3. Boltzmann L. The Second Law of Thermodynamics (1886). In B. McGinness, ed., Ludwig Boltzmann: Theoretical physics and Philosophical Problems: Selected Writings. Dordrecht, Netherlands: D. Reidel, 1974.
4. Brillouin L. Science and information theory. – M.: State Publishing House of Physical and Mathematical Literature, 1960.
5. Clausius R. Published in Poggendoff's Annalen, Dec. 1854, vol. xciii. p. 481; translated in the Journal de Mathematiques, vol. xx. Paris, 1855, and in the Philosophical Magazine, August 1856, s. 4. vol. xii.
6. Clausius R. On the Application of the Mechanical theory of Heat to the Steam-Engine. (1856) as found in: Clausius, R. (1865). The Mechanical Theory of Heat – with its Applications to the Steam Engine and to Physical Properties of Bodies. London: John van Voorst, 1 Paternoster Row.
7. Graves, Clare W. Levels of Existence: An Open System Theory of Values // The Journal of Humanistic Psychology, Fall 1970, Vol. 10. No. 2.
8. Grinberg S.M. Pedagogical risk and governmentality: shantytowns in Argentina in the 21st century. – SCARR: Social Contexts and Responses to Risk, Queens' College, Cambridge: Risk & Rationalities Conference, 2007.
9. Hens Z. Hemptinne de X. Non-equilibrium Thermodynamics approach to Transport Processes in Gas Mixtures, Department of Chemistry, Catholic University of Leuven, Celestijnenlaan 200 F, B-3001 Heverlee, Belgium.
10. Laidler K.J. The Physical World of Chemistry. Oxford University Press, 1995.
11. OED, Second Edition, 1989, Clausius (Pogg. Ann. CXXV. 390), assuming (unhistorically) the etymological sense of energy to be «work-contents» (werk-

inhalt), devised the term entropy as a corresponding designation for the «transformation-contents» (verwandlungsinhalt) of a system.

12. Magie W.F. The second law of thermodynamics; memoirs by Carnot, Clausius, and Thomson. Tr. and ed. by W.F. Magie/ – New York, London, Harper & brothers, 1899.
13. Marrewijk van M. A Value Based Approach to Organization Types: Towards a Coherent Set of Stakeholder-Oriented Management Tools // Journal of Business Ethics, Vol. 55, № 2, Social Dimensions of Organizational Excellence (EFQM-EOQ Convention 2003), 2004.
14. Mosleh A., Bier V. M., Apostolakis, G. A critique of current practice for the use of expert opinions in probabilistics risk assessment. Reliability Engineering and system safety, 20, 1988.
15. O'Hagan A., Oakley J. E. Probability is perfect, but we can't elicit it perfectly. Reliability Engineering and system safety, 85, 2004.
16. Planes A., Vives E. Entropic Formulation of Statistical Mechanics, Entropic variables and Massieu-Planck functions Universitat de Barcelona, 2000.
17. Prangishvili I.V. Entropy and other system laws: Control Problems of Complex Systems / Prangishvili I.V.; Management Research Institute named after Trapeznikova V.A. – M.: Science, 2003.
18. Schrödinger E. What is Life? (ch. 6 «Order, Disorder, and Entropy»). – Cambridge: Cambridge University Press, 1944.
19. Shannon C.E. A Mathematical Theory of Communication //The Bell System Technical Journal, Vol. 27, № 3, 1948.
20. Tikhomirov N. P., Tikhomirova T. M. Risk Analysis in Economy: Monograph. – M: Economy, 2010.
21. Wainwright J.T. (Jacob Tripler) An investigation of the second law of thermodynamics. – Chicago, 1913.
22. Winkler R.L. Uncertainty in probabilistic risk assessment. Reliability Engineering and system safety, 54, 1996.