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CONTEMPORARY SEMANTICS AND THE SENSE OF THE TERM «RISK»

The work contains an attempt to change the traditional approach to understanding of the notion «risk» – from probabilistic methods of its evaluation to event ones that have gained long ago a position in research and applied media by investigating and being applied in various spheres of activity from business and economics to social and industrial spheres. An event approach was suggested as the basic method, in which a chain of events in their time dependence, cause-and-effect relations that change with time from anticipated to real and also to an entropic approach ensuring the concept filling the notion of risk with information regarding reliability and presumption of anticipated events in time span infinitely close to real time. Investigated was the term synonymic filling and its semantic and functional senses, singled out were single properties of its synonyms and functions, as well the subject-object component of the most widely found descriptions of the original term. Represented was the functional model of the process of risk formation in event-logical system

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of time, information, energy. The article contains the results of investigation of experts' evaluations of different interpretations of the term «risk» in comparison with their consumer's priorities in the aforementioned coordinates system. It is argued that the designated formulation of the term «risk» in the parameters: time, event, entropy, as a paradigm of human responsibility for the processes and results of his activity, meets the needs of society for a certain level of safety, and consists of one of the main foundations of its own existence as a biological species. The final result of the work is the proposed definition of the term «risk», based on such properties like binary character, anticipation, dichromic character, uncertainty and vectorial character in «time-information-entropy» coordinates, which comprise jointly the base of possible risks in their time interpretation for a particular system.

Key words: risk, event, uncertainty, time, entropy, information, risk anticipation, synonymy.

Волошин В.С. Сучасна семантика та сенс терміну «ризик». У роботі зроблено спробу змінити традиційний підхід до розуміння поняття «ризик» – від імовірнісних методів його оцінки до подійних, які вже давно завоювали для себе місце у науковому та прикладному середовищі за допомогою дослідження та застосування у найрізноманітніших галузях діяльності: від економіки та бізнесу до соціальних та виробничих сфер. За основу запропонованої методики прийнятий подійний підхід, в якому основна роль відводиться послідовності подій у їх тимчасовій залежності, причинно-наслідкових зв'язків, що змінюються у часі від прогнозованого до реального, а також ентропійного підходу, що забезпечує смислове наповнення поняття «ризик» інформацією про достовірність та передбачуваність, серед прогнозованих подій у момент часу, нескінченно наближений до сьогодення. Вивчено синонімічність терміну та його семантичний та функціональний сенси для різних систем та сфер застосування, виділено однозначні властивості основних синонімів та функцій, а також суб'єктно-об'єктна складова описів шуканого терміну, які найбільш часто зустрічаються. Подано функціональну модель процесу ризикутворення в подійно-логічній системі координат: час, інформація, енергія. Наведено результати дослідження експертних оцінок різних інтерпретацій терміна «ризик» у порівнянні з їхньою пріоритетністю у споживача у зазначеній системі координат. Кінцевим результатом роботи є запропоноване поняття терміна «ризик», яке ґрунтується на таких властивостях як бінарність, очікуваність, дихотомічність, невизначеність та векторність у координатах «час-інформація-ентропія», які в сукупності складають основу можливих ризиків у їхній часовій інтерпретації для конкретної системи.

Ключові слова: ризик, подія, невизначеність, час, ентропія, інформація, очікуваність ризику, синонімічність.

Description of the problem. Risk, as an inseparable component of any human activity is subject to a system investigation, both from the point of view of methodology and in applied sense. A contradiction arises here between the contentive designation of this term, which, as a rule, is oriented on the probability method of evaluation of this index and its practical application, which almost never is oriented on the probability characteristics and being inclined towards applied parameters. Economic risks, for example, are oriented on such system's parameters like damage, financial losses, additional profits et al. While social risk in practical investigations is almost never connected with the probability of risky events, but contain some alternative damage for man's health, life, his social status, professional authority and other humanitarian indices. Just because the concept filling of the term risk has been shifted lately towards applied indices, there is a need to search for some new forms of the notion of «risk». This is the objective of this work.

The analysis of recent research and publications. Any type of human activity can easily be represented as a chain of events, consecutive in time, based on decision-making that leads to a particular event that could be connected with risk. At that time factor, energy its type and quality and information about the system [1-3] are inseparable components of such activity. Mostly often the definition of risks

is based on probability methods of their evaluation which, as a rule, are of «post factum» character [4]. It limits the opportunities for evaluation of a real risk, making some appropriate and timely decisions, aimed at risk prevention, it being vital for numerous applied spheres, where making appropriate practical solutions is required.

Purpose of the article – to form the concept content of the term «risk» on the basis of the up-to-date methodological principles of analysis of the sequence of events, comprising the base of risk formation outside the field of the probability methods of its evaluation.

Presentation of the main material. Risk is a derivative of some variety of notions that developed historically and had some certain content hierarchy. Let us consider a sequence of the following *synonymic* and *co-terms* (see Fig.1): *menace* (1), *danger* (2), *risk* (3), *uncertainty* (4), *fortuity* (5), *event* (6), *event's probability* (7), *decision making* (8), *given reality* (9).

This sequence is quite an objective not only in its semantic sense but also functionally, when each subsequent notion is a derivative of the preceding one. For example, risk becomes not only a clarifying synonym of the words «menace» or «danger». It brings some new concept content of these preceding terms. The same is appropriate for the sense chain «uncertainty», fortuity, event, given reality, or the chain «event-decision making-given reality» and so on and so forth

The degree of realization of an event, its correctness and ultimately-the correctness of the taken decision depend on a multitude of cause-effect links, including the state of the outer environment and may bring the desired result, or may not. It is this part of our terminological sequence that is responsible for the result of the event forecasted with some risk.

Thus, there appears an added terminological chain of «*monosemantic*» *functional terms*: *risk* (3), *uncertainty* (4), *cause-and effect relations* (10), *making a decision* (8) and in the long run – *real certainty* (9).

By combining these two chains we can get some notion about the value of each term we operate. Notion's menace and danger, as terms preceding the term risk in their meaning do not cause any objections (see Fig.1). But, obviously, at the intersection of the semantic and functional chains there appear some separate terms that seem to fall out of this logical chain.

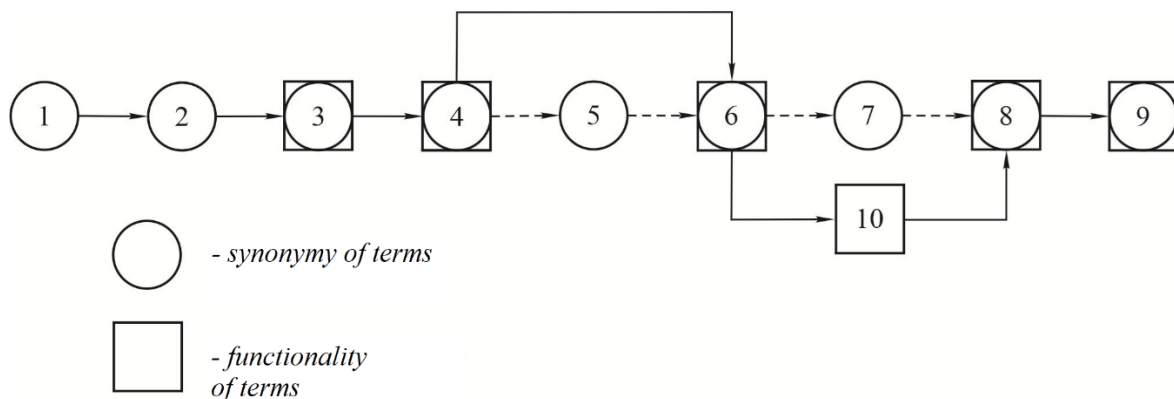


Fig. 1 – Synonymic and functional sequence of terms, connected with the notion of «risk» (indication as in the text)

Now, let us analyze the term «uncertainty». Uncertainty in the system means lack of information, i.e., a high degree of changes of entropy of the system itself. Certainty is characterized by the presence of enough amount of information regarding the system or its alternations and, consequently, reduction of alternation of entropy until its zero mark. The same is appropriate for the system's energy. In the most common case uncertainty and estimation of an event give an enormous scattering of the data regarding potential sources and ways of energy transformation for realization of this event, hence, alternations of the energy in such system are great. Quite the contrary the more specific a risky event is, when the time of its realization comes close, the more specific are the sources and ways of energy transformation, localization of alternations of entropy being ensured by that. The relation «uncertainty-quite certain event» lies, in this case, in the basis of such relations.

The man, with his purposeful actions is nearly always the main generator of risk. Another generator of risk is the outer environment, particularly nature. Both sources are largely spontaneous and possess the character of fortuitousness and uncertainty. Overcoming of risk can be represented as one of the ways of leveling of such casual processes from uncertainty to some certain situation both in human activities and in natural environment.

Some of such components, namely, time, information and energy (the last two in the form of integral index of changes in the system's entropy) and also aggregate causal connections are the basis for making a solution with a certain degree of risk (see Fig. 2). Such solution may result in an event, that due to its realization in present time passes from a state of uncertainty to the state of a realized event or certainty.

Thus, the notion of «risk» is easily reduced to its actual sense content, depending on the object of application and possesses some quantitative value in the form of a binary code.

The main difference in all mediated cases is the fact that *the binary relation* «1;0», denoting presence or absence of risk in the system remains the quantitative evaluation of risk. The event risk also has some binary character of its own, either as not yet realized but real risk «1» in some remote uncertainty and already realized zero risk-event «0» in the present time T_H .

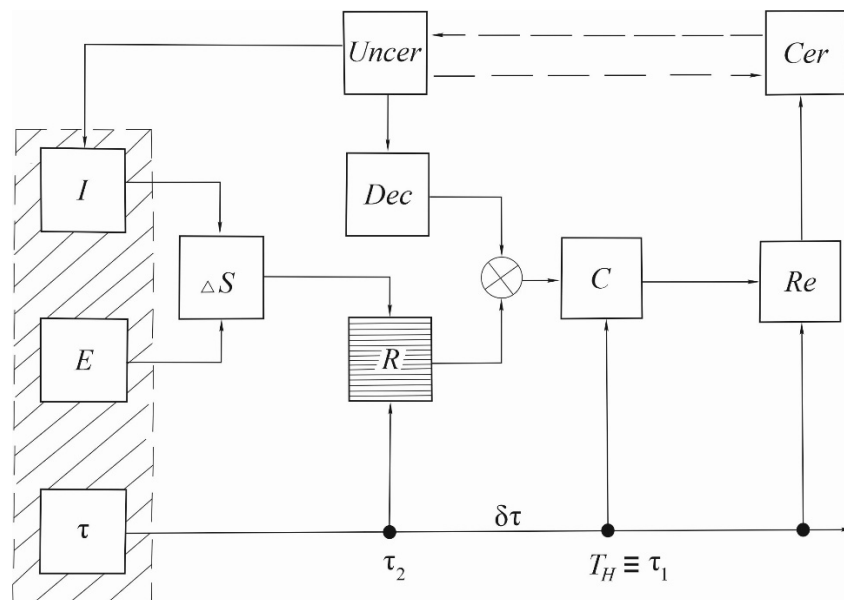


Fig. 2 – The functional system of risk formation in a logical system. I – information; E – energy; τ – time; ΔS – alternation of entropy; R – risk; Dec – making a decision; C – event; Re – result; Cer – certainty; Uncer – uncertainty

Involuntarily confirming a transitional «uncertain-certain» state of the system P. Bernstein described risk as *a signal* for mastering the strategy of behaviour under the conditions of uncertainty, irrespective of the degree of mastering of the future [5]. So, risk in general understanding is an indication of *a transitional process Dualism* is peculiar to the notion risk. Particularly, dichotomized character of the «risk» term is stressed in literature [6]. Typical pairs like «luck-loss», «win-loss», «danger-safety» witness that we have to deal with this particular property. Risk is often determined as a situation requiring making choice.

Nevertheless, we assert that eventful properties of risk are such that an event, as a predecessor of information regarding negative or positive differs from the semantic state of the notion of risk. Risk, in this particular case, is not the event itself, but its anticipation, *anticipation of a risky event* possessing a character of dichotomy, i.e., has a dualistic filling. It is possible to gain an understanding of objectivity and applicability of some or other terms «risk» in literary sources only together with the results of direct experts' analyses on behalf of those, who constantly use them in their works. The number of available sources of literary publications in open mass media and in Internet reached 200 units in the domains of applied risk studies, labor safety and technical systems, pre-accidental, ecological, economic and

cybernetic safety, those are the publications of the authors, who are engaged in risk engineering for different companies, banks, insurance and trade agencies, sponsoring such investigations and participating in research and practical conferences in Ukraine, Lithuania, Poland or Moldova. The experience gained by these specialists, their habit of operating with steady notions, on the one hand and their frequent dissatisfaction with the obtained standard result, giving little opportunities for analytical investigating, on the other hand, make their opinion quite objective in terms of the rules and terminology

We managed to collect opinions of 42 experts in the spheres mentioned above, including research workers and specialists working in the spheres of risk management and consulting. Some evaluations were taken from decent literary sources and were added to the available ones.

Expert's evaluation of some or other terms for the notion of: «risk», amounting to 60 points, was determined according to the scale, similar to the original scale of publications frequency in the available literature (approximately 0÷64 available publications). It gave us an opportunity to compare actuality of different terminological variants, used in literature with their subjective popularity among practical specialists and researchers in the domain risk studies.

The conventional difference between the value of expert's estimations and the actual index of actual mentioning of a specific type of the «risk term» may be considered as some function of expectation ($\pm\Delta$). If an expert's evaluation of the term exceeds the number of publications on that subject it may serve for specialists as information confirming actuality and good prospects of such definitions. And on the contrary, if an expert's evaluation is lower than the number of comparable and available sense publications it may be estimated as reduction in actuality of such interpretations of the original term.

Table 1

Objectivity and attributive of the notion of «risk»
in the available research literature and experts' evaluations

№№ item	Objective attribute of the notion of «risk»	Literature reference	Experts' evaluation (60 points on aggregate)	Anticipation index , Δ , (\pm)
1	Risk as realization of a menace	64	38	(-26)
2	Risk as a possibility of income change or receiving damage	57	44	(-13)
3	Risk as a probability of some event	44	53	(+9)
4	Risk of occurring an event which may cause violation of the system's functioning.	38	55	(+17)
5	Risk as event's frequency characteristic	29	28	(-1)
6	Risk as a sum of undesirable losses, depending on circumstances.	25	29	(+4)
7	Risk as uncertainty of events	16	36	(+20)
8	Risk as probability of an event in condition of occurring of another event	11	14	(+3)
9	Risk as a derivative of the product of probability by the sum of consequences	10	4	(-6)
10	Risk as conformity between the actual present and uncertain future	2	5	(+3)

If we group separate signs of risks that can be met most often in various literary sources, according to the degree of their lessening and correlate them with the results of experts' evaluations, given by specialists, who deal with risk engineering and research work (table 1) we may arrive at some conclusions regarding preferences, given to some or other definitions of «risk».

First, let us pay our attention at the general trend: the less references in literature the low is on the whole experts' evaluation for a particular risk definition. Particularly, ion literature references to risk as a realization of menace are met (in manufacturing systems) and its influence upon system's economic

indices (Items 1 and 2, Table 1). At that experts' evaluations of these two definitions appear to be not too high, it showing experts dissatisfaction at their application.

Attention should be paid to experts' high marks for risks terms that are connected with violations in the system's operation (item 4, Table 1), as causes of accidents, unfavourable results of works, human casualties, economic losses etc. The function of expectation for this notion of risk is high enough ($\Delta = +17$).

Vice versa the risks, connected with events, as their basis, occupy, so far, a narrow niche in the applicable literature, though their urgency is quite high among experts, as compared to other terminologies (item 3, Table 1).

Some definitions of risk, very important for us, connected with such notion as uncertainty (item 7, Table 1) also got their evaluations in experts' circles, as could be seen in materials of some scientific and practical conferences. A conventional difference between experts' evaluation and the number of literary references, as an expectation index for the seventh item (uncertainty of risk) is the highest for this analysis and amounts to 20 points. For the sake of comparison, such definition of risk as «mixed events» (item 8 in Table 1) has got a peculiar anticipation index equal just to 3 points.

Marks, far from being high and the frequency of quoting in literature testify that this direction has got some reserves for future investigations. Particularly, this work is very likely to be useful, in this plane, for specialists. Orientation on events, as subjectivity for the notion of risk may happen to be of use for inter-branch and poly-functional terminologies, which we may come across with in literary sources. Figure 3 may serve as a vivid example of it.

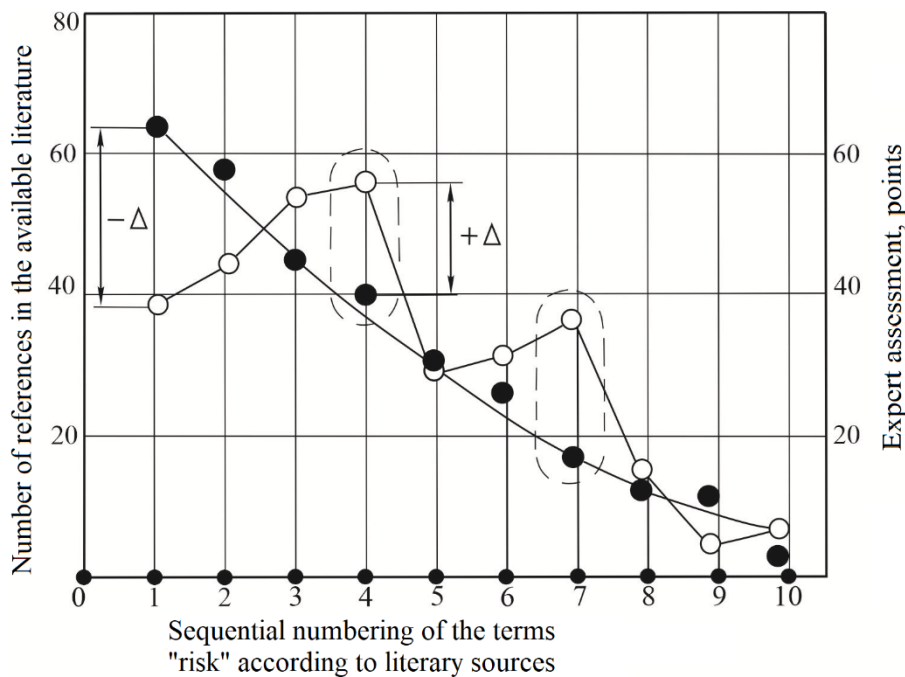


Fig. 3 – A graphical illustration of mentioning in literature separate notions of risk, compared to specialists' expert evaluations

On the whole, the risk definitions, connected with events reference points usually obtain rather high experts' evaluations, most commonly met probability and frequency characteristics of that notion occupying positions far from the top both in literature and in experts' evaluations. These concepts, that are very often exploited in different sources may have ceased to satisfy the researchers not only in the quantitative sense but also in actual sense filling of the results of investigations or engineering expert examinations. We may be induced to this conclusion by the example of numerous methods of investigation in risk engineering for economic, financial and insurance companies, which in the course of their functioning have abandoned long time ago the probability-statistic methods of risks analyses in favour of qualitative investigation of indices of risk. Purely economic indices – damage, loss, income, economic efficiency and the like are mostly often supposed to be the quantitative parameters, by which risk is estimated.

In this work, and also in the source [7] we analyzed three such items: event, time and the system's entropy, expressed through changes in information and energy. Within the scope of these considerations and judging by the materials published earlier we may give the following definition of risk. Risk is considered to be as a binary reflection of subjective anticipation of *an event* on the frontier of uncertainty. Risk, as an eventful characteristic is a derivative from the function of *time* arrow and minimization of growth of *entropy* towards its determined state. A graphical interpretation of this term is represented in Fig. 4. A corrected determination of the term "risk" may have the following sense.

Risk – is a binary reflection of the subjective anticipation of an *event* on the frontier of uncertainty, based on change in *time* and *entropy* towards its certain determined state. This definition appears to be quite complicated, though highly precise from the point of view of event filling of risk. More simplified definition of the term «risk» will be given below.

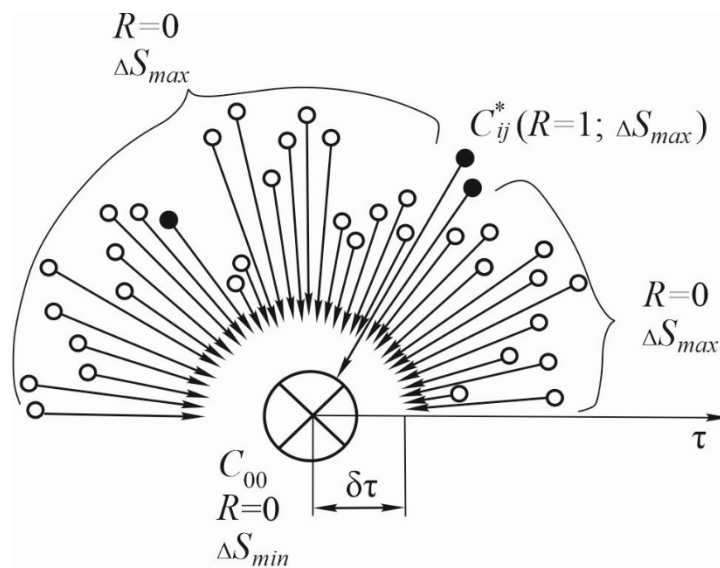


Fig. 4 – Graphical sense of the term «risk» within the coordinates «event-time-entropy». Here: C_{ij} – is the current state of the event from the supposed in future (i – the order of time interval; j – rank of the vent); C_{00} – the event that came true from the number of risky anticipated (C_{ij}^*); ΔS – changes of entropy of the system's state at transition from uncertainty to quite certain state; $\delta\tau \rightarrow 0$ – is an infinitely small time interval, separating uncertainty from quite certain state of the system

The binary character of expression in the notion of «risk» referring to some event, as «uncertainty-some certain event» or «1;0» depends upon the time frames of this event and the level of its concrete definition, determined as a change of entropy of the system within infinitely small-time span ($\delta\tau$) [7].

The term «subjective» is of some interest in the concept of «risk». This term expresses a variety of opportunities for different events from equally anticipated ones, from which only one has an opportunity to occur at the time moment T_H . Changes in time and entropy in the system testify that appearance of a risky event.

Changes in time and entropy of the system show that appearance of a risky event is a dynamic process, depending upon changes of these parameters. Application of the term «anticipation of event» corresponds to the property of dynamic character of the system, as it is one of the real processes of transition from uncertainty to a certain event. Thus, the proposed interpretation of the term «risk» corresponds to the properties of this notion, that have been analyzed in this work.

One more quality of eventful risk in time hierarchy should be mentioned here. Risk is a vectorial notion, possessing a singular orientation and coinciding in direction with the vector of events. It fully justifies the word combination «eventful risk», oriented from the supposed future for such event to the present, occurring in time moment T_H .

At first glance the complexity of such technical definition of the term «risk» and its explanations are connected with the number of defining indices-time, event, energy, information, entropy. But each

of them is active in relation to this term and is its inseparable component. The authors do have any preventions of exhaustion of this definition but insist on its objectivity. Equally such definition may seem unacceptable for the sphere of humanities, but it could serve as a pretext for some more serious interdisciplinary investigations. In this case it is possible to represent a simplified definition of the term «risk», that can be formulated like that:

Risk is alternative reflection of the subjective anticipation of an event on the borderline of uncertainty in direction towards its certain determined state.

In this definition time and vectorial dependencies remain obvious, designated by the term «anticipation» in a simplified form. The definition contains the concepts of entropy and dualism, which are connected by the word combination «alternative (binary) reflection». The notion of eventful character of the term is also preserved. So, the second the simplified type of the definition of the term «risk» is very close to those, proposed before. But here its sense acquires understanding for the society of humanities. It is possible that such definitions have the right for further development, but we are quite sure that this is the correct way to solution of a very complicated problem-providing a term for the contemporary variable phenomenon – «risk».

Now, let us analyze the components of this term, in its first or second interpretation, including the notion of subjectivity of risk, namely the subject of risk, its own object and the object of its pretensions. In this case:

– *the subject of risk* is an event, its anticipation, as the property of this even within the framework of the existing and constantly changing information0time interval of the subjective system itself. It is the event that governs risk;

– *the object of risk* is the man, or an objective system created by him, that undergoes risk;

– *the subject of risk* is the sphere of human activities, which includes the actual event, the environment and changes of information and energy and sometimes the preceding events.

An event should be treated in this discourse as a rate notion, being a sense filling of the term risk. In its etymological sense the term «event» us often referred as something which is happening or has already happened. In Russian its roots go back to the words «be» and «being» –actually denoting the existing or existed. Such words like fact, phenomenon, incident are its synonyms. Still the event can denote something that *is supposed* for what is going on, depending upon the external circumstances and suppositions, judging by analogues of the past. It is an anticipated event and its variants that are to come to us from the assumed future with some time interval. In philosophy even such concept like the problems of time and space and the sense of being are explained by this term [8]. Important for our investigation is only the sense of event and its time filling.

In this sense the notion of «event» may have the following extension for the subject of our investigations, which, of course, cannot pretend to be comprehensive in its content.

Event – Event is an order of actions, predicted by man or consecutively realized that in a dynamic aspect change the system or its parts in a required or arbitrary direction.

The subject of event is the external environment, i.e. something that nearly always is the subject to the term «risk».

The object of event is the man and it nearly always is comparable with this notion for the term «risk».

The object of risk is the sphere of man's activities and it also can be compared with the corresponding sign for the term «risk».

Such single-sense filling of two terms under consideration – «risk» and «event» allows us to confirm their gnoseological correspondence. It is extremely important for the proposed interpretation of the term «eventful risk».

It should be mentioned here that the binary character of reflections does not coincide in the terms «risk» and «event». Risk, as a binary reflection in the direction from uncertainty to certain state is in «1;0» relation, but «event» as a fact is in the opposite relation «0;1», i.e., in uncertain state, because there is no event yet, but the moment of certainty of this event has already occurred.

Now, let us consider in what way the notion of risk, corresponds in the etymology, proposed by us, to the definition given earlier, with reference to the already known. Table 2 shows the differences in subjective-objective orientation for different variants of the definition of the term «risk», taken from literary sources and referring to different objective-functional systems of an applied character. Their

differences can be seen both in relation to the subject and the object of this system and for the subject of pretensions within the framework of the quoted terminology.

It concludes from the comparison of the represented signs that:

– at least two indices of the objective-functional characteristics of each of the known definitions (depending on the sphere of professional activities) coincide with the response indices of the proposed by us more universal, as we are convinced, definition of the term «risk»;

– terminological coincidence for the objective-subjective parts allows to carry out significant comparisons, included into different notions of the term «risk»;

– the aggregate sense notions, referring to the term «risk» for different types of risk forming systems and the proposed definition of the term «risk» give an opportunity for their generalization, including according to their semantic signs. Practically in all definitions a general sense can be traced: danger of loss, and, hence, risk originate from certain events, they are directed to man or the spheres of man's activities and they depend on the subject of phenomenon, i.e., on external conditions and on man's activities. In different definitions only subjective – objective relations change, the sense filling of the term remains intact, although with some limited functional designation.

Conclusions

So, it may be concluded that our definition of the term risk within time, event, entropy parameters correspond, as a paradigm of the social responsibility of human beings for the processes and results of their activities to the society's inquiries for certain level of safety and is one of the principal fundamentals of human existence as species.

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