Ekometrics of economic activities

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Ekometrics of economic activity: *The experience from studies of hazard, risk, threat, criticality and environmental security is summarized. The main ideas of a new direction in security are defined. They revealed regularities and interactions of economic activities in their environment. The purpose, objectives, objects and principles of ekometrics. Ekometric's technology, which is considered as a system of knowledge about the laws, addictions, procedures, methods, tools and rules to measure the security of the environment is proposed.*

Key words: *environment, safety, danger, hazard, risk.*

Security is an indicator of the quality of every person's life. It plays a key role in the economic activity, political stability and rule of law in the state of security in international relations.

Security of international economic activities e significant problem because of the globalization of the world's economy. Economic activities within the meaning of NACE Rev.2 are realized in a specific internal and external environment that influence their effectiveness. We need to create a security environment. The status and influence of the environment should be managed by an appropriate tool which at present does not exist. The metrics of the environment, which is the most important indicator when making management decisions, have not been developed as a scientific and applied problem.

The purpose of this work is to propose and define the foundations of a new direction in security - ekometrics which allows to reveal the patterns and interactions of economic activities in their environment. To achieve the goal two problems are solved:

1) Defining the nature of ekometric and its basic principles,

2) Presenting the technology of the ekometrics.

The ekometric's purpose is determination of a safer environment for performing economic activities . The object of ekometrics is the environment. Ekometrics is subject to all the conditions of the environment. To create the ekometrics we apply six key principles:

1) The principle of the hierarchy. It consists in defining the security of such magnitude decomposed in a tree structure. Security is described by a set of general, higher to private and lower parts, constituting,

2) Principle of the integrality. The measurement of the security is the process of defining an integral indicator reflecting events, actions and effects with a positive or negative nature,

3) Principle of the dimensionless. It is expressed in determining the differential indicators of occurrence of the component and the integral indicator as dimensionless real numbers,

4) Principle of the equal meaning. It consists in assuming that composing the integral indicator of security of certain hierarchical level are of equal significance;

5) A principle of cause-effect relationships. It is expressed in definition of the security as a set of events that are connected by relations "cause-effect";

6) Principle of the ordinarity. It is represented by the logical and chronological sequence of security's definition " danger - risk - threat – criticality - security."

The environment is considered as a set of natural, urban and socio- economical environment. Environmental security is a situation without generation of dangers and threats. The hazards are defined as a real or hypothetical scenarios:

1) Suspected, accidental or naturally occurring events, which are caused by natural, urban or socio- economic phenomena,

2) Dangerous agents, processes and effects on environmental objects and

3) Causing harm.

Threats are specifically established or proven hypothetical scenarios for hazards that are built for specific real-life situations, i.e. with certain values of the indices of the constit-

uent phenomena impacts and effects. Situations are defined by nine indicators - space, linear and angular coordinates of events, history, ordinarity, event's action, environment, causality, metrics and context.

Dangers and threats related to the environment are defined as:

I. Dangers and threats in the environment,

II. Dangers and threats from the environment,

III. Hazards and environmental threats.

The four theses were discussed:

1) The environment creates a dangerous phenomena. In its various configurations it is able to identify the causes of dangerous phenomena, references that generate hazardous factors and their levels of nuisance. The natural environment forms disasters, urban environment - technological disasters, socio - economic environment - social and economic disasters.

2) The environment is a "channel" for the spread of dangerous factors. It is an area of issuing threats and immision in the space and time of action.

3) The environment is a living environment and a component of the natural, urban and socio-economic systems.

4) The environment is a space of occurrence of the hazardous effects - damage, injury, economic, financial and other losses. Therefore, beside the first two integrated hazards - dangerous occurrences and hazardous effects, the environment is a holder of the consequences in the context of the security and having the nature of damage.

Modeling is the basic method in ekometrics. The ecometrics technology is a system of scientific knowledge about the laws, relationships, procedures, methods, tools and rules to measure the security of the environment. It covers six basic procedures - problem- target modeling, logical- formalized modeling morphological modeling, causal modeling, simulation and axiological and praxiological modeling.

In problem - target modeling a model of explicit and implicit dangers and threats and their derivatives is developed. Based on them various types of differential scenarios can be generated. Each has a separate purpose, scope and boundaries. Scenarios navigate to a specific field of problems. The scope and limits of the applicability define the relevance of the scenarios in the management of security. In the formulation of the problems of scenarios dangers and threats are:

1) Analyzed explicit and potential problems that contain or may occur in situations of danger,

2) Establishing conditions of occurrence of the problems,

3) Classify problems,

4) Characteristics and rank problems defined,

5) Establishing the possible consequences of hazards and determine the priority of occurrence and its frequency and severity of the consequences.

The problems are grouped into general and private. The general problems are valid for all the tactics, methods and techniques for the management of security. To the private problems can be attributed classifications subjectivity of risk assessment, perception and communication of risk, morbidity and trauma, mechanism of formation of relationships of inheritance, methods and findings in the investigation of the critical situations.

Logical - formalized modeling aims to construct such a description of situations which natural language is to recreate most comprehensive options of them. Based on the subjective perception of dangers and threats, which is a process of complete reflection of their indicators. Logical - linguistic memory is a main provement of the need for formalized modeling of hazards, risks, and threats as combines concepts, thoughts, reasoning and deduction.

Logical - formalizing modeling is a lexical structure that reflects the options and their constituent lexical units reflecting the elements of danger [5].

Differential scenarios of the phenomena, impacts and effects that are described lexically, form the "skeleton" of the dangers and threats to, from and to the environment. The

variables of each differential scenario in detail can be formalized by selecting appropriate verbs and through prioritization of cause and effects. They are universal and can be adapted without restriction for all types of situations of danger. The whole system of formalization of hazard is open and without restrictions may be supplemented and developed. On the basis of logic-formalizing modeling it is going to build the morphology of the dangers and threats. It is a graphical improvisation of the structure of the integral hazard.

The causal modeling is done by determining the correlation between events, united in the morphology of the dangers. To determine the relationships between events the instant correlation coefficient of Pearson and the coefficients of K. Reyski [1, 2] are used. The aim is to establish causal relationships with significant correlation. Therefore, it is necessary to reveal the forms and to interpret the relationships that model the dependencies and relationships between the events.

Causality, in the strict sense of the word, is sufficient. In the broad sense, it can be interpreted as fact, comparison, shape and mode of the action, place, time or occurrence, appearance, generation.

Two categories of cause - effect relationships in patterns of the hazards were adopted. The first category is the "cause - true events", and the second category is "reasons - false events". «Real events » in models of hazards and threats and thus the security of the environment are:

1) phenomena, and
2) actions, and
3) effects,
4) processes
5) sites;
6) environments,
7) times,
8) spaces;
9) states,
10) the facts,
11) factors and parameters;
12) goals: a) the conceivable outcomes, b) ideas for something which man strives to achieve c) an idealized cause, which was brought from the future to the present d) reason for conscious business of the people,
13) the circumstances: a) The necessity and sufficiency of occurrence of the phenomenon, b) a requirement of a certain character, b) condition c) setting d) circumstances.

In the second category „Causes - false events" include: 1) the opposite cause and consequence , 2) unrealized cause and effect, and 3) logical controversial cause and effect, 4) insufficient reason; 5) rejected reason, 6) reverse argument; 7) invalid argument. Cause - effect relationships can be represented by inclusions or phrases for alleged addictions. Then the formalized expression of causality can be expressed by composing the associations with the logical operators - AND, OR and NOT. It is possible to introduce the additional criteria such as "possible" - "impossible", "occasionally" - "permanently", "when" - "then", "if" - "it" [3, 4, 6].

In the axiological modeling a system of criteria and rules for evaluating scenarios of hazards is used. It includes: 1) Selection of evaluation criteria, 2) Creation of a scoring system, 3) The evaluation procedure, 4) Evaluation and interpretation. For a basic criterion for quantitative definition of scenarios is accepted the risk. The risk is defined as a vector of probability and the time of occurrence of the events of the dangers. Using it is possible to report the influence of each component of the scenarios. The result is a general value that reflects the risks in a complex of all the components.

The assessment system consists of a factor, indicator, component, differential and integral risks. The factor risk reflects the probability vectors and the time of occurrence of the dangerous factors. They are used to determine the critical factor. The indicator risks are vectors of occurrence of the elements of danger. A system of three sub-indicator risks,

dangerous occurrences, hazardous effects and harmful effects is adopted. They form a critical indicator. Component risks of third level reflects the simultaneous occurrence of the indicator groups risks of dangerous phenomena, dangerous effects and harmful effects. Differential risks of the fourth level are critical criteria for the joint appearance of the components of the integrated hazards. Integrated risks of the fifth level combined differential risks for both the appearance of the component criticality. To apply the vector method it is built an axiological models of the three groups of risks and corresponding criticality.

The evaluation procedure includes:

1) Determination of the probability and time of the occurrence of events in the scenario, and

2) Calculation of the elementary vectors risks,

3) Establishment of the areas of the value of basic risks,

4) Determination of the center of the field of values,

5) Calculation of the vector of factor indicator, component, differential and integral criticality,

6) Determination of the component, differential and integral security.

Probabilities are detected by checking the statistical laws of distribution or expert analysis. The values of the vector risks were calculated. Factors of the influence determinating the importance of the probability of occurrence or the time of this occurrence are inserted. Arrangements are also factors of importance that form the regulation of the risk for the occurrence of dangerous phenomena, dangerous effects and dangerous impacts through the value of the integral risk. The influence's ratio and importance ratio enable detailed view into the nature and development of the risks. It is entered grading and ranking.

The values of the factor, indicator, component, differential and integral criticalities are defined. Based on them two conditions are defined - a state of the uncertainty in the environment and the state of security.

Praxiological modeling includes:

1) The selection and construction of private and generalized scenarios,

2) Evaluation of the performance of the essential functions of scenarios,

3) Determination of the structural and functional weaknesses,

4) Establishment of the uncertainty and ambiguity in the scenarios,

5) Determination of the resultativeness and efficiency.

The selection is made by choosing the scenarios for the security descriptors - hazard, risk, threat, criticality, vulnerability, security. Factor scenarios recreate the generation of hazardous factors. Indicator scenarios are constructed in a similar manner. They represent the largest collection of scenarios as above chain remakes each of their components. This class of scenarios make sense of classifications of the essential performance of each component. Component scenarios are common. They cover all scenarios describing their constituent elements. Differential scenarios unify scenarios for each pair of key components. The integral scenarios summarize component and differential scenarios. The second task - to assess the performance of the essential functions of the scenarios is decided by evaluating the correlations. The main provisions of the international standard ISO/IEC 17000 is used.

The third task - determining the structural and functional weaknesses are easily solved. They are seen even when moving from polisituational to monosituational models. The lack of connection between the items, wrong logical sequence, unclear functions of constituents, inaccurate descriptions of the circumstances and conditions of occurrence of the elements could be seen clearly. To solve the fourth task - establishment of the uncertainty and ambiguity in the scenarios introduces three categories and their appropriate classes, quantitative uncertainty of model uncertainty and ambiguity. The fifth problem is associated with the determination of the resultatativeness and efficiency. The resultatativeness depends directly on the performance of the scenarios. Effectiveness of scenarios can be identified by comparing the effect of protection from the dangers and costs required to achieve it acceptability of risk must be justified in details. It is a key issue that affects a

number of consequences of human and material nature.

Summarizing these considerations the following conclusions are made.

Our experience in studies of hazard, risk, threat, criticality and environmental security is summarized. It allows to define the main ideas of a new direction in security - ekometrics of economic activity. This direction makes it possible to reveal the patterns and interactions of economic activities in their environment.

The purpose, objectives, objects, and principles of ekometrics are presented.

A technology of ekometrics is proposed, which is considered as system knowledge about the laws, addictions, procedures, methods, tools and rules to measure the security of the environment. The technology combines six basic procedures of modeling - problem-targeted, logical-formalized morphological, causal, and axiological and praxiological modeling. They were developed as attributes of a scientific study to assess the security of the environment.

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The report is reviewed.