

The perception of the ecological risks

Taurida National Vernadsky University

1. The importance of human risk perception

In risk analysis and risk management it is very important to take into account risk perception of people. Perception of risk – it is an individual (or collective for a society) sense of danger that comes from event the realization of which is possible in several ways (from favourable to varying degrees of unfavourable), an intuitive definition of its size and response to it. Individual attitudes to risk are based on the innate psycho-physiological characteristics of the individual but also on his acquired experience and knowledge, adapted according to the assimilated socio-cultural norms of life activity [1].

When considering the issue of risk in environmental management it is important to consider two groups of events: 1. when the straight (direct) role of a person does not appear; 2. when subjective preferences of people (groups) have a tangible (and sometimes very large) impact on the situation, in particular on the amount of damage. In the first case a dangerous event affects the technical object, the natural system or social system and causes damages that may be assessed according to accepted methods. That is an event that is independent of man, realized with a certain probability, impact on technical objects, natural or social environment of the system and cause some damage. The risk in this case is calculated due to the fact that the events are realized with a certain probability, and that the damage from it is also realized with a certain probability.

In the second case, the decisions are made in anticipation of the event if there is a certain probability of information: for example, a decision on the motion on the highway, waiting for the flood or hurricane, or a decision of the commission of crossing the mountains with the likelihood of avalanches, etc. Information on possible hazardous event is not complete, is probabilistic, therefore a person's decision about the relevant decision-making (preparation for a hurricane or flood, bridge type selection based on the level of security, the decision of the commission of a campaign or its cancellation) is due to risk. Different groups of people would react differently to the information available and will then make a more or less risky decision. Thus, such decisions reveal the role of a person's character and his mentality, which can lead both to success as well as to large losses.

How the situation is changing depending on the person's perception of events?

The perception of risk is often influenced by local traditions (ethnic, national differences), for example, in states with Spanish culture bullfight is seen as entertainment, whereas the British, consider such risks barbaric. In many regions of the world where natural hazards occur quite often, people adapted and got used to co-exist with them, considering them as usual. In these regions, the fundamental principle of life is the concept of «life at risk,» where the risk is regarded as an integral part of life. In other areas, the problem of risk perception is more important for territorial organization, design and construction of various structures.

Thus, the perception of risk by populations of different countries is an important factor in determining the extent of extreme events in the natural and manmade disasters. Socio-economic and psychological factors are extremely important, and sometimes play a major role, they are often dependent on the extent of damage.

2. The culture of the risk perception and the types of human behavior at risk

Risk culture – is the totality of our ideas, attitudes and beliefs, values, habits, traditions and customs in terms of knowledge and practice of risk management. Scientists have

found different approaches to national models of risk management. For example, west society has developed in the course of their evolution rather effective mechanisms of adaptation to natural and man-made risks, based on non-economic methods, civil risk management, development of environmental culture based on individual responsibility of each member of the society for the entrusted object and the environment in general.

The degree of rootedness of cultural stereotypes in the mass consciousness allows to distinguish among the advanced industrial societies the Japanese and Chinese ways of thinking as the least inclined to tolerate all sorts of risks. The idea of predestination of fate in the Arab civilization and the «unhistorical outlook» in Indian culture allows characterizing their attitude to risk as relatively carefree. High is the «riskiness» of the Russian world view [1].

In countries that emerged after the collapse of the USSR, the science for a long time showed no interest in the issue of risk. They were seen as inevitable price to pay for the ongoing development of society in the processes of modernization, industrialization, urbanization, etc. The society formed a kind of stereotype where society and individuals are not responsible for the consequences of the interaction of the productive structure of society and the natural environment that manifests itself in the environmental risk and emergency man-made situations. Dominating is the setting on paternalism in the development of methods of the natural environment which removes the individual's responsibility for the environmental impact of his economic activity. A kind of illusion of security against any emergencies was formed. Lack of attention to this problem in predicting the state's economic policies have led to the risks and dangers that have become a serious obstacle to the reform of society.

Technological changes accomplished lead to increased risk and risk diversity in all areas, the need for constant analysis and evaluation. In this regard, an important place should be given to particular risk-culture, study of its features, its role in today's complex world order, taking into account the socio-psychological differences in the perception of risk by various categories of people.

According to the character of attitude to risks all people are divided into **riskophilous** and **riskophobic**. As research shows, distribution between riskophobias and riskophilous in a modern society varies in such limits: 95-97 % – riskophobias and 3-5 % – riskophilous. At the same time, scientists, investigating risk-culture, have found out different approaches in **national models** of risk management.

The risk culture passes certain stages of development during a life of each person. The majority of people – riskophobias under forty dare to make risky decisions. After forty years ability and desire to make risky decisions is essentially reduced. This tendency cannot be applied to riskophilous who make risky decisions which are more and more difficult every year concerning risk. One of them is the traveler explorer Feodor Konjuhov.

The risk is perceived by everyone in its own way, it cannot be estimated equally – the basic thesis which has been put forward by D. Bernoulli in 1738 in his article «The Statement of the New Theory about Risk Measurement», published in «Imperial S.-Petersburg Academy of Sciences News» where he formulated his well-known **Saint-Petersburg paradox**: estimation of the utility of goods is not a simple linear function and depends on the person who is in a risky situation [2]. Bernoulli's idea was that the decision-making people pay more attention to the size of the effects of different outcomes than to their probability. Thus, the knowledge of the price and probability is not always enough for the value of an outcome as utility in each concrete case can depend on the subject making estimation. And each subject reacts to risk according to the system of values.

The scientist criticizes the standard assumption, that expected value of a random variable is calculated by multiplication of all possible values to number of cases in which these values can take place, and division of the sum of these products into the general number of

cases. In his paradox D.Bernulli's puts forward the thesis, that the price for which the coin is thrown, is inadequate to average winnings. He puts forward the thesis, that the value of something should not have price as a basis, but utility which is associated with benefit, desirability or satisfaction. It took two hundred years before D.Bernulli's ideas have received the further development – only in the fortieth years of XX century the theory of utility by D.Neumann and O.Morgenshtern allowing to find optimum decisions in conditions of risk has appeared.

Recent most significant research of human behaviour at risk and uncertainty were executed by psychologists D.Kahneman and A.Tverski [3]. The most famous was their «prospect theory», in 2002 D. Kahneman was awarded the Nobel Prize in economics. A phenomenon of the asymmetry in decision-making aimed at achieving a win, and to avoid making a loss became a doubtless important result of the prospect theory.

In prospect theory formulated by the phenomenon of asymmetry in decision-making aimed at achieving a win, and decisions to avoid losses. As a result, missed winning has less effect on the situation than the realized loss.

Separation of erroneous decisions on the errors of the first and second kind is due to the fact that consequences of various kinds of erroneous decisions fundamentally differ in terms of what a missed win less effects on the situation than the realized loss. For example, for a stock broker the consequences of the shares not being bought, when they should be bought, differ from the implications of the situation when the shares were purchased, but they should not be bought. The first situation can mean the loss of profit, the second – direct loss up to the ruin of a broker. Similarly, refusing to seize power in a revolutionary situation for a politician is different for the consequences of a lost attempt to seize power. For a general to launch a military operation, which will be lost is much worse than to miss a situation where it was possible to lead a successful operation.

The strategic objective of analytical services (as opposed to other units of investment companies) is not to increase profits but minimize potential losses.

The nature of decision making under uncertainty and risk is well illustrated by the example of so-called payoff matrix (Table 1). Its rows correspond to the alternative predicts of a hazard, and the columns correspond to the two versions of events: the «dangerous phenomenon has occurred» and «dangerous phenomenon has not occurred.» Matrix elements are combined effects of combinations depending on the choice of decision (prediction) and the implementation or lack of hazard.

Table 1.

Payoff matrix structure

	D1	D2
F1	S11	S12
F2	S21	S22

F1 – predict of a dangerous phenomenon

F2 – predict «without event»

D1 – a dangerous phenomenon has occurred

D2 – a dangerous phenomenon has not occurred

S11 – a dangerous phenomenon was predicted and happened, the measures taken reduced the damage

S12 – a dangerous phenomenon was predicted, but it did not happen, measures to prevent it were superfluous

S21 – predict of the absence of a hazard, but it happened, the consumer is caught in a dangerous phenomenon by surprise and suffered extensive damage

S22 – the lack of a hazard prediction came true, protective measures were not taken.

The forecast by the phenomenon is based on total information available and the established laws of phenomena dynamics. The greatest damage will be at combination of S21, that is, the forecast «without event» and «dangerous phenomenon has occurred.» The complete absence of damage will be at combination of S22, i.e., when the forecast was «no hazard» and it was justified. When combined with S11 some damage is associated with the manifestation of a dangerous phenomenon. Although his prognosis was made, and steps were taken, but it is impossible to fully anticipate all the nuances of the hazard. When combined with S12 losses occur because of the costs of preparation for hazards in connection with this prediction. But the forecast was not justified, that is, the measures were in vain.

Forecasts of this kind occur in the practice of the weather forecast at the airports. In these situations, we have the so-called asymmetry in the selection of variants of the forecast. Forecasters often see advantageous to provide a hazard prediction, for a total of variants of S11 and S12. The other pair of combinations of S21 and S22 in total lead to more damage. This is due to the fact that the combination of S21 is extremely dangerous and can cause major damage and even death. Then the pair of combinations S11 and S12 gives small losses.

The spanish philosopher J.A. Livraga [4] proposes to combine a reasonable amount of comfort with a reasonable degree of risk. Devoting himself to the search for comfort, we do not leave space to risk, and conversely, if we only run the risk, it leaves no room for comfort. «Thinking only about comfort and not giving yourself opportunities to take the risk, we lose our spirituality, creativity and inner strength. Choosing a risk and completely forgetting about comfort, we make our lives too harsh and austere, and most of us are not ready to that. You need to have common sense, ability to recognize, to be able to choose the one that provides the comfort and the necessary risk».

3. People's perception of hazards

Between the estimated and actual risks are significant differences caused by inadequate perception of risk by human beings. Different experts repeatedly conducted surveys that revealed the attitudes of people to risks. It turned out that the most dangerous, in terms of people and events that threaten their health and lives, are not necessarily those in reality. Different social groups differently assess the contribution of various risk factors to such index as overall mortality rate. In addition, the same people or groups of show different behaviour with respect to various risk factors. And often the attitude to these factors does not correlate with the calculated value of risk. For example, they smoke and fly airplanes, use the services of railway lines – hence, risk and consider the risk acceptable. Some are involved in skiing or climbing, which is absolutely not safe, but they consider such risk acceptable, and the possibility of premature death as not worth special attention. Alongside with this the adjacent industrial enterprise is the subject of furious attacks of the same people, although the risk of diseases associated with its emissions and discharges is negligible, even compared to the risk of dying as a result of unsuccessful surgery.

Professionals usually evaluate risks as objective, but most people see them as purely subjective. Objective measurement is expressed quantitatively and is often detected by a number of algorithmic techniques. Subjective measurements can not be reduced to numbers, but in practice it often outweighs the objective approaches [5].

In the U.S. the perception of risk by the Americans, representing the three social groups was investigated [6]. Three groups of people were asked to arrange 30 possible sources of increased danger in order of decrease. Statistics for these sources was compared with the average results of the survey (Table 2). The first group consisted of women (members of the League of Women Voters), the second – high school students, the third – businessmen.

Table 2.

Results of priority risks survey

Type of risk	Number of deaths In USA per year	The order of priority, in agreement with estimates			
		Estimated *	Institute students	Members of academic and professional associations	Members of the League of Women Voters
Smoking	150000	1	3	4	4
Alcohol	100000	2	7	5	6
Auto	55000	3	5	3	2
Fire guns	17000	4	2	1	3
Electric shock	14000	5	19	19	18
Motorcycles	3000	6	6	2	15
Swimming	3000	7	30	17	19
Surgery	2800	8	11	9	11
Railways	1950	10	23	20	24
Private planes	1300	11	15	11	7
Construction works	1000	12	14	13	12
Hunting	800	14	18	10	13
Housekeeping	200	15	27	27	29
Fires	195	16	10	6	11
Civil aviation	130	19	16	18	17
Atomic power	100	20	1	8	1
Skating	18	24	25	16	21
Food dyes	Not fixed	26	20	30	16
Pesticides	Not fixed	28	4	15	9

* Priority in accordance with the number of deaths per year in the U.S.

As these estimates affected on damage? Relevant groups of people according to their scores (priorities) vote for adoption of the budget, in which the main costs are allocated to hazards which seem to be paramount. This is not the case in reality.

According to the results of the survey it is clear that nuclear power that women and students placed in the first place, and businessmen – in eighth place in the sequence of decreasing risk, is in reality (according to statistics) in the twentieth place (Table 3).

Table 3.

Ratings of perception of sources of increased danger and statistics

Women	Students	Businessmen	Statistics
1. Nuclear power	1. Nuclear power	1. Fire guns	1. Smoking
2. Automobiles	2. Fire guns	2. Motorcycles	2. Alcohol
3. Fire guns	3. Smoking	3. Automobiles	3. Automobiles
4. Smoking	4. Pesticides	4. Smoking	4. Fire guns
5. Motorcycles	5. Antibiotics	5. Alcohol	5. Electricity
6. Alcohol	6. Motorcycles	6. Fires	6. Motorcycles
7. Aviation	7. Alcohol	7. Work in police	7. Swimming
8. Work in police	8. Work in police	8. Nuclear power	8. Surgery
9. Pesticides	9. Fires	9. Surgery	9. X-ray radiation
10. Surgery		10. Hunting	10. Railways
			20. Nuclear power

Let's consider another example. According to the experts of the Agency for the U.S. Environmental Protection in the early 1990-s, the most serious environmental risks were as follows:

- Global climate change;
- Depletion of the stratospheric ozone layer;
- Change of the components of the environment;
- Loss of populations and loss of biological diversity.

The ranged list of leading positions in the results of a survey performed in 1990 in the United States is listed below. Top 20 risks of a long list are given; in brackets is the percentage of respondents who classified the according environmental risk as «very serious».

1. Existing landfills of hazardous waste (67%).
2. Inactive (old) landfills of hazardous waste (65%).
3. Water pollution by discharges of industrial enterprises (63%).
4. Chemical toxicants in the workplace (63%).
5. Oil spills and oil (60%).
6. Ozone Depletion (60%).
7. Accidents at nuclear power plants (60%).
8. Accidents in the industry, leading to the emission of pollutants (58%).
9. Radiation from radioactive waste (58%).
10. Air pollution by industry (56%).
11. Leaks from underground storage of petroleum products (55%).
12. Pollution of coastal waters (54%).
13. Solid waste and garbage (53%).
14. The risk of pesticides to farmers (52%).
15. Water pollution by runoff of agricultural enterprises (51%).
16. Water pollution by treatment facilities (50%).
17. Traffic Air Pollution (50%).
18. Residual pesticides in food products (49%).
19. Greenhouse effect (48%).
20. Contamination of drinking water (46%).

Comparing this list with the above expert opinion shows that ordinary people and experts have different opinions the importance of an ecological risk. Thus, the poll did not reveal any increased concerns of global climate change, or exposure to radioactive gas, or reduction in biological diversity. Experts and laymen disagree on the severity of the risk posed by the constantly increasing number of hazardous waste landfills. These differences are partly due to differences in awareness of experts and ordinary people, but special studies have revealed a number of other reasons.

4. Factors and mechanisms of risk perception

People's attitudes toward risk form the multiple factors and mechanisms. Brief description of the main ones found in the publication of P.A.Vaganov and I.Man-Sung [7].

The factor of concentration means, that events as a result of which the human victims, grouped in time and space appear, cause the amplified perception of risk in comparison with the events, the victims of which are disseminated in space and time.

So for example, the explosion at the chemical industrial complex in Bhopal (India, 1984) has carried away lives of more than 4 thousand people; Spitak earthquake in Armenia (1988) – 25 thousand people; tsunami in Thailand in 2003 – (and in other neighbouring states in Southern and South Eastern Asia, as well as in five African countries) – 200-300 thousand people. Meanwhile, the total amount of victims and injured people at auto accidents is also rather considerable, but they occur in different places, at various times and are perceived not so sharply.

The factor of affinity and acquaintance. The risks connected with objects (events, phenomena) which are in sight of those interrogated, the influence of which is obvious and quite tangible are perceived as more dangerous. The risks, caused by little or absolutely unfamiliar phenomena or processes, are hardly perceived. So, the majority of people do not know, why the use of some substances (freon and other hydrogen fluorides) brings about an exhaustion of an ozone layer of the Earth, but they are well familiar with lightning stroke consequences. The fire in the house in the next street is perceived much «closer to heart», than in the distant Latin American country. The risk of death in military operations in Afghanistan, Iraq, North Africa is perceived much worse if a relative or a good friend is there.

The factor of concreteness (identifiability of victims) manifests itself in different attitude of people to specific individuals, victims of dangerous situations, and the so-called statistical (unidentified) victims. The risk of the group of miners trapped in a blockage on depth is perceived much more serious when the time and the place of accident is known, in comparison with the perception of statistics data on the average number of miners perishing under the ground annually.

The factor of understanding and definiteness is due to the fact that these phenomena or processes are clear to ordinary people. The offbeat risk generates considerably much more serious tension in society, than habitual, traditional one. The less is understanding, the more is the internal anxiety and mistrust and, consequently, the less is the tendency to perceive the corresponding risk. For example, the degree of perception of the risk associated with the influence of radiation, is respectively, lower, than the risk to which a person crossing the street is exposed.

The factor of uncertainty in consequences of events or processes causes an aggravation of perceived risk. The smaller is the volume of the available scientific data characterizing the event, the more intensive is the perception of the caused risk. The projects of creation of storehouses of highly radioactive waste products in geological profiles which contain a number of uncertainties, connected first of all with necessity of maintenance of ecological safety during the long term (about 10 thousand years) can serve as an example. The factor of uncertainty strengthened the risk of realization of the first space flight, the first exit of a person in an open Space, the first experiment on European collider, etc. The danger inaccessible to perception, fantastic, out of limit, generates more fear, than accessible, clear danger. On the basis of ignorance the false fears, frequently preventing from perceiving the scientific argument, appear.

The factor controllerness of actions or events also influences different perception of risk and is shown as an opportunity realized by an individual to influence that action in which he is involved. If the person finds himself in a situation the development of which occurs irrespective of his personal control, he is inclined to bigger anxiety for consequences of this development. The person driving the car perceives the risk to have an accident to a lesser degree, than his passenger. The possibility to participate in risk monitoring increases his social acceptability. In particular, the situation when the government or the managing subject take the responsibility under the control over risk only on itself, is perceived by a society more negatively.

The possibility of population to get the information for taking control measures reduces the perception of danger of estimated ecological risk. Now some enterprises whose management understands the importance of development of industrial ecological monitoring and connection of these kinds of activity with public control install in accessible places the indication boards with lighting indications of instrumentations. Such demonstration of observance of the established scientific and technical specifications makes sense when some most problematic parameters cause constant anxiety in local population. The second condition is obvious: it is necessary to observe specifications at all operating modes of the enterprise.

Any regulating devices allowing the person to avoid uncomfortable conditions and to change and monitor them, considerably simplify the perception of serious risks (the button to call the

doctor at a bed of the patient, medical clocks – tonometers, air conditioners in rooms and on transport, videophones on entrances to the houses, the autoalarm system and other).

The factor of voluntariness to undergo the risk influences rather essentially its perception. People running risks at their own will (mountaineering, parachutism), reflect on it much less. On the contrary, the economic risks caused, for example, by pollution of drinking water or air are perceived painfully as at all are not voluntary. The voluntary risk is always more comprehensible, than compelled. In a society always there are people, ready to run the risk for the sake of the relatives (for example, giving lives necessary to/for rescue the bodies (skin, a kidney, blood). For the sake of any idea which have seized with the person (political, religious, scientific), despite the dangers, risky acts were made. Cave explorers voluntary risked while opening new karst cavities, skin-divers from Jacques Cousteau's group, the doctors struggling with epidemics of cholera, plague, smallpox, etc. People thirsting for mountain skiing or high-mountainous ascensions, risk to get a severe injury, but the voluntariness factor works.

Therefore in case of transition of ecological risk to voluntary category, its estimation will change. It is done exactly so while presenting certain economic privileges to inhabitants while developing the territories with extreme conditions (high mountains, Arctic regions, deserts, etc.), building harmful, risky manufactures. If the accommodation occurs in coordination with the established norms and rules, the society considers the risk of that accommodation and actions comprehensible. If the accommodation occurs with deviations or infringements of the mentioned norms, and the society is confronted with a *fait accompli*, that it is forced to risk, there will be a firm bias.

One more of the known laws defining the level of comprehensible risk – under condition of observance of the legality, the established norms and regulations/rules the risk is estimated as more comprehensible. In practice it means that it is essential to follow the established norms and rules not only from the point of view of mutual relations with authorities/power, but also from the point of view of establishment of confidential relations with the local population. If in any variants the accurate procedures are not stipulated, it is necessary to establish clear «game rules», to discuss them at the meeting with the public.

The factor of influence on children results in strengthened perception of the risk caused by such events the consequences of which would affect, first of all, children. The danger of hit of pesticides (toxic agents/substances) in the products intended for children's food can serve as an example. Close to this factor is the risk for the future generations from influence of the processes connected with generation of genetic defects, induced by ionizing radiation. Also people are disturbed by the use of GMO in children's food. Inexperience and defencelessness of children makes the perception of any risks more frightening. While estimating of risks, it is always necessary to remember, that there are less «average» people than parents with children.

The factor of time of display of effects is connected with the situation that consequences of dangerous events vary greatly in speed of their development. The perception of the risk caused by detained effects, is more intensive, than from immediate displays of influence of negative factors of inhabitancy. For example, the risk associated with the use of products, containing GMO, or reception of a radiating irradiation a little above the norm, can keep people for a long time in suspense and trouble expectation. The risk connected with cold (which is usually cured within a week), is perceived as insignificant.

The factor of attention of mass media has special value in connection with fast development of TV, communication media and computer networks. If people do not pay attention to any dangerous events their perception of risk is as though impeded. But the moment the data on such phenomena appear in headings of news – corresponding risks reach much higher level of perception. Unfortunately, the aspiration to raise ratings of the programs at the expense of «special» news and facts (about acts of nature and emergency situations) in conditions of global information of the population promotes frightening perception of any

risk. Quite frequently all plots of news telecasts consist of fear forcing, then the perception of regular routine events gets a shade of risky action (risk to meet the maniac, to suffer at terrorist explosion in a cafe, to receive an excessive irradiation using a microwave, etc.)

The factor of intimidation means, that the risk is perceived in a special way if together with perception there is a feeling of strong alarm, fear and horror. An example of such reaction is the aggravated sense of danger from possibility of repetition of an accident of Chernobyl type.

The factor of convertibility of dangerous events (processes) influences the perception of the risk caused by them differently, depending on whether they are convertible or not. Irreversible events (an acid rain, for example) are characterized by strengthened perception of the risk, reversible (broken leg of the skier after unsuccessful descent from a mountain) – by weakened one.

The factor of trust to those institutes which bear the responsibility for management of risk. The information causes the more trust, the better is the reputation of a source of distribution of data. For the population it is necessary to provide full, accessible and trustworthy information about a risk source. And if in the past the mutual relations of your enterprise with local population were far from being confidential, you shouldn't expect the adequate perception of all materials offered to public.

This factor weakens the perception of risk at high level of trust and on the contrary, strengthens perceived risk at deficiency of trust to the specified establishments. Now «the Chernobyl syndrome», i.e. the risk caused by the possibility of accidents at the atomic power stations, is perceived very sharply, rather than earlier presented by the Ministry of atomic energy. The public outlook stores the prints of past impressions long enough. The memory about them, sometimes subjective, even deprived of logic, strengthen the negative perception of risk.

Sources thoroughly studied by science and threat displays are traditionally more comprehensible, than those not studied enough.

The factor of previous history of accidents. Its influence is that the risk of activity in the process of development of which there were no major accidents (catastrophies) is perceived as unimportant. On the contrary, if in the history of manufacture or other activity were both small failures, and accidents the risk is perceived as rather serious. The history of nuclear power remembers, as it is known, some major accidents, the consequence of which is the stressed perception of risk. Such events of last years as terroristic attack/act on September, 11th in the USA and in the Vnukovo airport (2010), capture of hostages in Moskow (Nordost) and Beslan, explosions on mines, hijacking of planes, fires in Greece, Spain, Russia (summer of 2010), etc. have not remained traceless for the formation of relation to risks.

The factor of validity/justice leads to essentially different relation to dangerous event (process) depending on how the corresponding risk is distributed between the members of society. If the risk is distributed in more or less regular intervals, the influence of this factor is insignificant, however it sharply increases at obviously uneven distribution of risk. Financial crisis of 2010-2011 in Greece has caused a wave of protest demonstrations in many respects because of unfair increase of financial risk for the most part of the population and its weakening for banks and high officials. The degree of threat is estimated higher when the action which has served its precondition is represented as more immoral. So, in the area being the usual cult object of the Buddhism, the realization of the project of gold mining has been started. One of the very essential details, in particular revolting local population, was that even at preliminary stages the project was connected with huge amount of boring works. Thus, by Buddhist tradition it is considered a great sin to make wounds to the earth. Buddhists even wear footwear with inflexed socks to not wound the earth. And here – drilling! it's no use to be surprised by the indignation of a local community. With the sources of threat usually perceived by a local society as awful, the higher risk is connected.

The factor of origin reflects the distinction in perception of the risk caused by anthropogenous and not anthropogenous dangers. The sensitivity to the risk caused by the dangerous influences (or inactivity) of people, is higher than the risk caused by natural phenom-

ena or display of the supreme forces. The natural phenomena under certain characteristics bring much more contribution to environmental contamination, than the anthropogenous reasons. And, nevertheless, the society, compelled to be reconciled with threats of natural origin, is not going to be reconciled with «man-made» threats. So, the overestimated radiating background in mountain district does not confuse local residents, but even small «additives» to this background by technogenic sources can strengthen the negative attitude to possible risk and lead to occurrence of conflicts. Finally, such reaction is natural: people have lived for centuries at the foot of dozing volcanoes, suffered disasters from flooding and hurricanes. And they accepted it, though with some pain, but without insults: in fact it is – from above, from the God.

Thus, the threats of natural origin are viewed as more comprehensible, than anthropogenous ones. The adaptation to ecological risks assumes the control not so much at the natural environment, but at the technological, administrative and professional culture of a concrete society.

The factor of benefit depends on how obvious is the benefit which is supposed to be taken as a result of risk influence. If the advantage is clear, the influence of the factor of benefit is little, and otherwise – is great.

The subjective perception of ecological risk depends on features of the personality characteristics, life experience, psychology of perception of victories and defeats. The perception of the current situation influences the choice of tactics and strategy of decreasing the risk. When winning people usually try to reduce the risk and to keep the available. When they sustain growing losses, because of stress they become more inclined to risk (especially if there is nothing to lose).

There are also *other factors* considerably influencing social acceptability of ecological risk. So, the modern sociology asserts, that the risk level preferred by a group, is above the average level admitted by individuals, and group decisions as opposed to individual ones are more objective.

The unusual new risk, as a matter of fact, generates essentially more serious tension in a society, than the habitual, usual one. New threats for the health of people appear constantly, in cities in particular.

Among different directions at management of risks the formation of the proportional attitude of people to probable extreme situations is important. Among them is the studying of arising *new risks and preparation* of people for their adequate perception. Frequently these new threats are connected both with occurring global events, and the events at the local, household level. Modern risks, unlike the risks of the past, being determined by the dependence of a person from nature and external circumstances, are generated mainly by the activity of people. English sociologist A.Giddens [8] noticed, that «we live in the world where the dangers created by our hands, are even more serious, than the ones that come to us from the outside».

Many scientists agree that modern society is called the society of risk. For example, Ulrich Beck [9] thinks in the last third of the twentieth century mankind has entered a new phase of development associated with the post-industrial formation, which became known as a risk society. J.P. Moatti in the «Vulnerable Society» [10] notes that the man's desire to expand his sphere of influence has resulted in the disruption of world harmony and balance in nature, which accelerated the awareness that society becomes «civilization of technological risk.»

5. The determination of the acceptance level risk

Determining of the acceptance level of risk is important to resolve the conflicts that arise more often: the cautious attitude of people to new technologies and science could be explained by the fact that science is breaking into the consciousness of man, changing and destroying the old truths and dogmas. Public opinion, defending its interests, often contradicts with the interests of the state and business entities, and sometimes the people themselves. Opposing the

introduction of new technologies and associated with them new risks, the society, however, can not completely eliminate the use of their results in everyday life (for example, knowing about the harmful radiation from mobile phones, people still use them).

The perception of risk changes with age, physical condition and state of mind of man. From young age to adulthood the perception of risk is becoming faster, and to old age again slows down, reflecting the change in degree of responsibility for the lives and well-being of family and friends. At the same time, women generally are more cautious than men.

The rate of risk perception is influenced by such factors as rapid changes in the environment (variations in the heat and pressure state of the atmosphere), bursts of social tension, the complexity of technological processes, administered by the operators. It is established that 40-80% of accidents, and industrial and transport accidents are due to the perception of risk by the operators, which is not fast enough [1].

Adequacy of risk perception between the estimated and actual threats requires the development of methodology for studying this problem. In order to do this, a variety of approaches is already used – technocratic, sociological and cultural studies, etc. The influence of all these factors on risk perception can be studied quantitatively, as it is done in psychometric studies. A weighted dependability, which can take discrete values (1, 2, etc.), is attributed to each factor, corresponding to subjective quality assessment of the impact factor («very weak», «weak», «medium», etc). Then the surveys, which involve several dozens or hundreds of respondents, are made. Survey data are processed using the method of multivariate statistics (as a rule, the factor analysis).

While making the economic-territorial decisions one can focus on *the scheme of risk systematisation* in terms of their perception by people as «dreadful» [11]. As a rule, the risks controllable and not observable are ignored, partly the limits are taken for controllable observable risks (the left side of the diagram). Observable uncontrollable risks cause fear and protest, and non observable and uncontrollable risks frightening because of their uncertainty (often accumulating unverified rumors) cause the state of panic fear (Figure 1).

Thus, people always are under the impact of political, economic, environmental, psychological, legal, medical and many other risks. Some of the most dangerous of them are connected with security of the lives of individuals, families or corporations, and society as a whole.

Conclusion

1. The perception of risk by people may appear in different forms:

– Competent behavior in the case of jogging at risk – the corresponding response reaction, defined by certain established rules, for example, a fire at a hotel, an accident on air transport, the occurrence of extreme weather events, etc.

– Inadequate perception of the events: confusion, chaotic, hectic actions, not following the recommended rules of conduct in such situations.

– Panic, «stupor» of effective actions, inertia.

– Apathy, paralysis of mental activity, «be it, as it may,» «it is destiny!»

– Manifestation of the heroic deeds – to rush into a burning house to rescue people, get into the debris of mines, in deep waters, «stop the gap», save other people.

Accordingly, the management structures should be ready to different variants of human behavior in response to dangerous risk situations.

2. There are different types of people according to their perception of risk in different countries, and in different communities. In each region, the management structures should have the data not only on material values, technical, economic and other characteristics of a particular region, on human potential, demographic characteristics, but also the psychological, behavioral characteristics of people who can influence the effects of extreme events, possible damage in case of risky situations.

3. It should be noted that although all possible actions are taken to reduce the risk, but they are inevitably accompanied by loss of material, cultural, environmental values. It

is necessary to prepare infrastructure for prevention and mitigation of risk consequences, aiming not only at «exemplary» individuals, but at all other categories of people, who react differently at risks.

4. The permanent improvement of the forecast of the increasing risks is necessary. For example, at least one-third of the Earth population lives in the areas of immediate seismic and volcanic hazards, for them the problem of forecasting is extremely urgent. The development of geoinformation system for global monitoring of volcanic and seismic activity of the Earth may minimize the damage from these hazards in future.

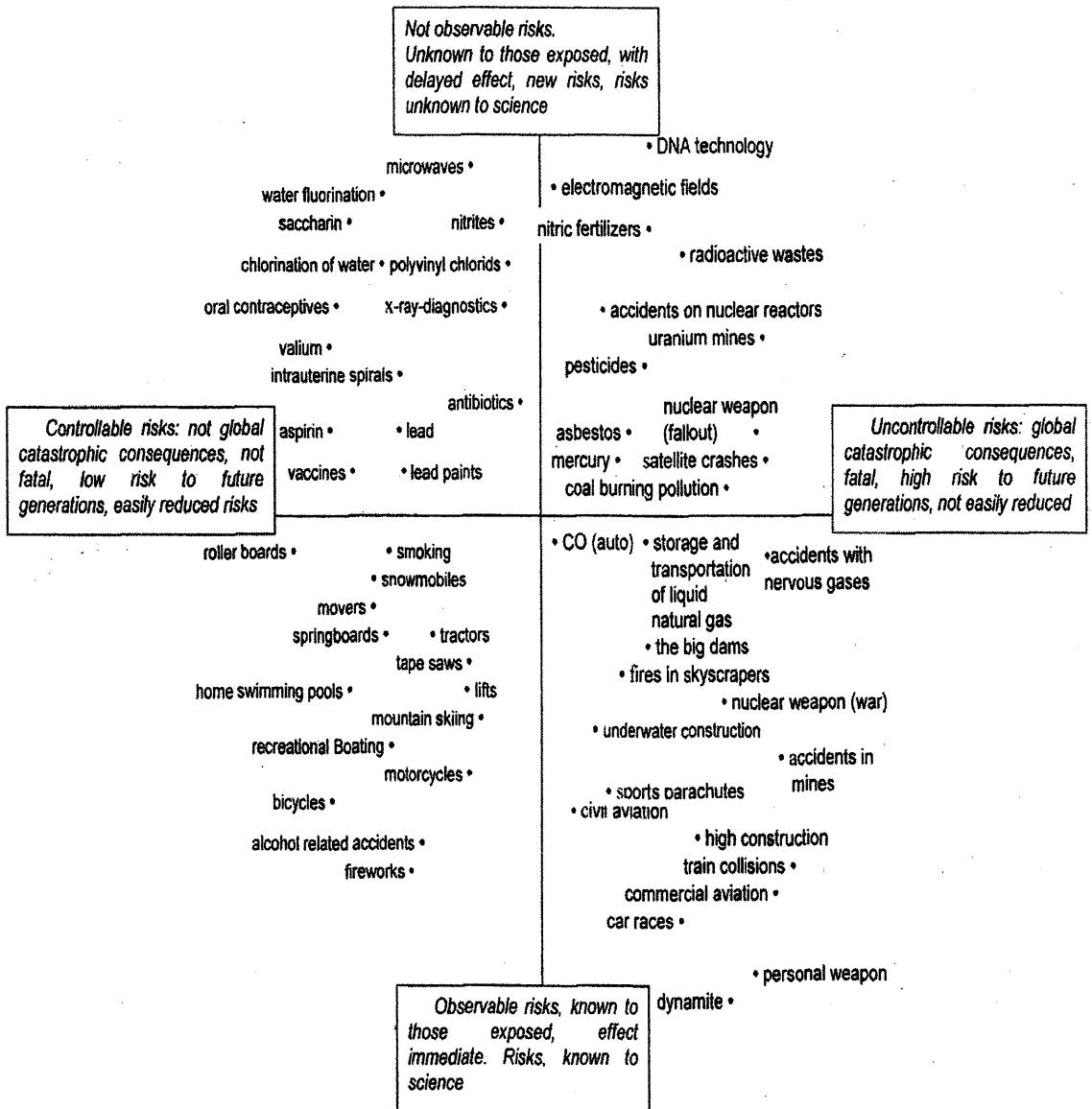


Fig. 1. The space of risk has axes, linking a hazard's controllability (the degree of dreadfulness – vertical axis) and degree of its observability (understanding – horizontal axis). The risk in the top right quadrant demands the greatest necessity of governmental regulation (Morgan, 1993).

On the basis of forecasts the strategies of development should be developed – after March 2011 – it became clear that Japan should create the strategy of existence and development, taking into account constantly present in the area natural factors (and their cumulative effects: earthquake + tsunami + ...). This strategy should include the development of methods for monitoring and prediction (if they had known in advance about the earthquake and tsunami on 11 March, people would have gone from the coast, and the energy specialists could suppress the reactors in standard mode at their nuclear power plants).

5. An important factor in controlling of extreme risks to our lives is *the upbringing and education*, from early childhood, and the formation of the so-called risk culture. With the help of various business games it is possible to get the skills of dealing with these or those risks, develop management solutions for standard and non-standard situations. Permanent education and awareness-rising work on bringing up of stability of behavioral stereotype of people on formation of a risk culture is necessary.

6. Special training activities that simulate the appearance of risk situations and ways to minimize the damage with their probable (possible) manifestations are required. These may include courses on safety and civil defense, program of actions on large enterprises in the case of industrial accidents, explosions, catastrophes, etc.

REFERENCES

1. Vaschalova T.V., Myagkov S.M. Social and cultural features of people's attitude to risk/ Natural and anthropogenic processes and environmental risks. – Moscow: 2004 (russian).
2. Bernoulli D. Specimen theoriae novae de mensura sortis. Commentarii Academiae Scientiarum Imperialis Petropolitanae, 5. – 1738.
3. Kahneman D., Tversky A. Prospect theory: An analysis of decisions under risk. –Econometrica 47 (2). – 1979.
4. Livraga J.A. The Spirits of Nature. New Acropolis Cultural Association, Coral Gables. –Florida, U.S.A. – 1999.
5. Gdaedel T.E., Allenby B.R. Industrial Ecology. Second Edition. New Jersey: Published by Pearson Education. – 2003.
6. Radiation: doses, effects, risk. – 1988 (russian).
7. Vaganov P.A., Man-Sung Im. Environmental risks. 2 Edition. – St.-Petersburg: 2001 (russian).
8. Giddens A. Runaway World: How Globalization is Reshaping Our Lives. Publisher: Routledge; Revised edition. – 2002.
9. Beck U. Risk Society: Towards a New Modernity. – London: Sage. – 1992.
10. Moatti J.P. Vulnerable society. – 1989 (russian).
11. Morgan M. G. Risk analysis and management. Scientific American, 269 (1). – 1993.

Поступила в редакцию 20.07.2011.