INTRODUCTION

Expert assessments: taking into account the human factor

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Human factor. This terminology is familiar to every person. Even at the everyday level, everyone uses this concept when discussing certain events that led to some consequences. These can be not only accidents or disasters. This may be a way out of a person's comfort zone caused by external circumstances. Changes in the route of movement of vehicles, which lead to delays on routes and delays, failure to receive any services or poorly provided services, which require additional time for a person, etc.

Who is to blame for all these unwanted events? Obviously, there are fundamentally three answers to this question: uncontrollable external circumstances are to blame, the system is to blame, or people are to blame. In the first case, someone is powerless, because it is impossible to prevent, for example, natural disasters. It is only sometimes possible to predict their occurrence based on the use of modern technical and technological means and systems, but with a certain degree of probability. In the second case, it is possible to predict and purposefully manage events, preventing the occurrence of undesirable ones by continuously monitoring process parameters and implementing automatic control over them. In the third case, if a forecast is possible, it is only with a huge degree of uncertainty. However, even in the first two cases it is impossible to do without human participation. Such a person may be an operator who, due to his/her incomplete competence or fatigue, or under the influence of other factors, such as psycho-physiological nature, makes mistakes. Therefore, there are always risks of undesirable events, and even if their probability is minimal, it cannot be ignored.

The operator's activity comes down to control and management, which is inherent in the technical systems themselves. Therefore, with high qualifications and a high level of professionalism of the operator, such systems operate with very high reliability indicators, which guarantees the safety of everyone who uses them. However, the mechanisms of functioning of technical systems are based on the fundamental laws of physics, chemistry, mathematics, etc., that is, they are characterized

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mainly by the certainty of controlled parameters. The situation becomes more complicated when it comes to organizational and technical systems, where people appear as components of control. And this is where uncertainty arises. In this case, the operator must have assistants, for example in the form of decision support systems. Such systems generate tips and recommendations for the operator, built in advance on the basis of an analysis of the functioning of specific organizational and technical systems. However, given the fact that in such systems there is an uncertainty factor in the assessment of states, some adequate criteria for such assessment are necessary. The lack of completeness of data and fundamental knowledge about objects makes it impossible to accurately describe such systems using known laws, which is replaced by the use of expert assessments. A new subject emerges – the expert. This is a person who has a certain set of knowledge, competencies, experience in a specific subject area, who can be the bearer of opinions about specific systems, their functioning, features, etc.

The appearance of an expert makes it possible, on the one hand, to obtain some data about systems in qualitative and quantitative terms. In the absence of accurate knowledge about the system, this is still the only way to obtain more or less reliable information. However, on the other hand, the human factor component is increasing, and not only at the level of systems management, be it organizational, technical, social, or any other systems. In this case, it is the experts who are involved in creating decision support systems, which generate tips and recommendations for operators.

Involving experts to form ideas about an object necessarily requires compliance with the principle of collegiality in the sense that each expert must express his/her judgment, after which all judgments are processed in some way to develop a common decision that is accepted as the final conclusion. It should be noted that such processing of opinions, which actually requires assessing the degree of agreement between experts' opinions, is based on the use of well-known statistical methods. Therefore, the opinion of experts is assessed quantitatively, as a rule, on a point scale or in some standardized units. This is quite convenient, however, even if we do not take into account possible strong differences in the opinions of individual experts even on one specific issue, such an assessment is initially based on a not entirely correct methodology. This is due to the fact that the expert's opinion is not a random variable. Therefore, strictly speaking, it cannot be described by some kind of distribution law due to the fact that it is impossible to obtain the distribution density of an expert's opinion precisely because it is not a random variable. An expert's opinion is a fuzzy quantity, for the description of which it is necessary to use methods of fuzzy mathematics, characterizing it quantitatively with a set of parameters: modal value, membership

function, compactness of the uncertainty body. Moreover, this apparatus is invariant with respect to the subject area for which experts are involved and, obviously, more accurate, despite the very concept of fuzziness underlying it.

However, even having quantitative estimates obtained by tools of mathematical statistics or fuzzy mathematics, one should not forget that any expert operates with only a fraction of the input information. Applying his/her knowledge and experience to its processing, s/he forms an opinion that concerns only the local area. To confirm this, it is appropriate to recall the well-known parable of the elephant and the blind men, when the experts involved, who did not have the opportunity to see the elephant and did not imagine it visually, correctly determined what individual parts of the elephant's body looked like but were unable to describe the entire elephant.

All this forms a potentially interesting and invariably relevant scientific topic that could consider the study of expert assessments, methods of their formation, principles of use and selection of the profile of expert groups, as well as their relationship with intelligent decision support systems and, of course, artificial intelligence technologies. It is important to note that this scientific issue itself is multidisciplinary, covering not only borderline scientific areas but also areas that are far from each other in traditional ideas about the classification of sciences. These could be Social and Humanities, Health Sciences, Physics and Engineering, and Life Sciences. In today's global world, there is a need for a broader perception of science as a tool for obtaining practical knowledge. And, given that the proportion of objects of human civilization that are clearly described by fundamental laws is relatively small, the development of the apparatus of expert assessments, regardless of a specific subject area, comes first. Therefore, this topic is inexhaustible, and we consider the proposed monograph as the first step towards broad coverage of topics related to examinations, their impact on risks, safety, and determining their place in decision-making systems in various realms of human activity.

In this monograph, the problem is considered in the following practical domains of knowledge:

– forensic examinations, the quality of which and the correctness of procedures in the context of new technological innovations and new objects of examination directly determine the receipt of objective conclusions by citizens;

– the construction of a decision support system for experts in the field of medical diagnosis of leukemia, with the ability to scale to identify other diseases in which blood cells undergo changes, such as Covid-19;

– use of the Internet of Things (IoT) to formulate solutions regarding ensuring the safety of personnel working in the oil and gas industry, taking into account the human factor;

– intelligent management of the human factor, as an aid in decision-making by experts in addition to knowledge bases about hazards, based on the concept of a human-centered approach, which involves the inclusion of experts in the control loop on oil platforms as objects with an increased level of operating hazard;

– methodology for conducting expert assessment of engineering and planning solutions, organizational and management measures to ensure road safety.

We hope that the solutions proposed in this monograph could be useful not only from a theoretical but also from a practical point of view. I also express the hope that the results of these studies will inspire colleagues, stimulating them to present to the world their developments in this interesting area of knowledge related to expert assessments of objects of any nature operating under conditions of uncertainty.

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