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Are human factor risks in the activities of scientific design organisations subject to reliable measurement?

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Abstract

The article considers the problem of measuring risks and threats created by the nature and charac-teristics of the human factor and affecting the efficiency and safety of activities at the micro level of the economy, in particular, in the environment of scientific and design organisations during the development of restoration projects at immovable cultural heritage sites located in St. Petersburg and the Leningrad Region. A literature review of sources covering the problem under study is carried out. The objective of the study is formulated, which consists in attempting to measure the impact of human factor risks on the efficiency of scientific and design work, and the tasks are outlined, the solution of which will allow the objective to be achieved. The study focuses on the assessment of complex damage and indirect losses, and the subject is defined as the methods for measuring the impact of these risks. The methods and tools of the planned study are defined. A number of intermediate author's results are obtained, clarifying the nature of the human factor, the conceptual apparatus of the topic, the classification of risks, threats and dangers that can cause significant damage to an economic entity, market activity, business reputation and brand value. Partial results were discussed and five-stage conclusions were drawn. Promising directions for further joint research have been identified by the authors of the article, which can be considered as the starting point and the beginning of the path in the systematic study of the problem of human factor hazard metrics.

Keywords: human potential, risk, treatment, error, event, entity, phenomenon, innovation stress, immovable cultural heritage, restoration and construction works.

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研发机构活动中的人为因素风险是否可以可靠地衡量？

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简介

文章探讨了如何衡量自然和人为因素造成的风险和威胁，以及这些风险和威胁对经济微观层面活动效率和安全的影响，特别是在圣彼得堡和列宁格勒地区不可移动文化遗产修复项目开发过程中科学和设计组织的风险和威胁。　对涉及所研究问题的资料来源进行了审查。制定了研究目标，其中包括尝试测量人为因素造成的风险对科学和设计工作效率的影响，并概述了为实现目标而需要解决的任务。该课题的研究对象是复杂损害和间接损失的评估，并确定了测量上述风险影响的程序。确定了计划研究的方法和工具。已经取得了一些中间成果，澄清了人为因素的性质、这一主题的概念装置、风险、威胁和危险的分类，这些风险、威胁和危险可能对经济实体造成明显损害，损害其市场活动，损害其商业声誉和品牌价值。对部分结果进行了讨论，并得出了五个阶段性结论。确定了文章作者进一步共同研究的方向，可将其视为从人为因素出发系统研究威胁度量问题的起点。

关键词： 人的潜能、风险、威胁、错误、事件、本质、现象、创新压力、不可移动文化遗产、修复和建设工程。

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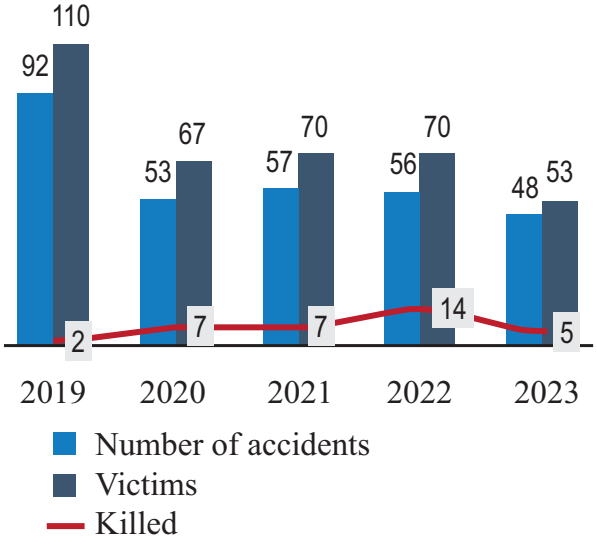
Introduction

A serious approach to various epistemological kinds of risks and taking them into account has long been an integral part of the productive, economic, financial and other activities of any organisation. The principles and forms of managing some risks are even included in local documents, including in the development strategies of these organisations of different legal forms of ownership. This is mostly related to known circumstances that should not only be mentioned, but also clearly disclosed:

Firstly, the ability to generate real benefits that are fully commensurate with the risks taken into account; secondly, the ability of the organisation to absorb potential damage, losses and claims arising from a range of all types of risks and those associated with its core activities; and thirdly, the risk of finding itself in situations of insolvency and bankruptcy, which are common in a turbulent economy. However, it is extremely rare to find organisations that have thoroughly studied and practically adopted recommendations on the currently highly relevant category of risks directly related to the influence of the so-called human factor (hereafter referred to as HF). It is here that we cannot help but take a look back at the actual history of this phenomenon.

The first comprehensive surveys of all types of accidents that occurred in various sectors of our economy did not include accidents caused by human error - man-made incidents, so to speak. However, in the early 1930s, human error began to be considered as an independent cause of accidents [Tumani-shvili, 1932]. However, a long time has elapsed between the inclusion of every cause of an incident (from a routine fire to a major man-made disaster) in a separate cadastre of 'human error' and the systematic application of every effective means of combating human error.

Fig. 1. Information from Gazprom Mezhregiongad Group on the number of accidents and victims in 2019–2023



Source: compiled by the authors.

Table 1
Analysis of accidents in the Gazprom Mezhregiongaz Group
for 2019–2023

Ranking	Main types of accidents with victims	Main causes of accidents
1	Road traffic accidents	Failure to take personal safety measures
2	Damage caused by workers falling	Traffic violations by third parties
3	Damage caused by contact with plants and animals	Illegal actions by third parties
4	Damage caused by the illegal actions of third parties	Attacks by dogs and wild animals
5	Damage caused by high-risk work	Poor work organisation
6	Damage due to collision with objects/parts/mechanisms	Violations of work, production discipline, requirements of regulatory documents
7	—	documents

Source: compiled by the authors.

Nevertheless, this time was usefully spent in collecting reliable statistics on incidents by industry and sector of the economy, and in preliminary - essentially desk-based - analysis by multidisciplinary specialists. Thus, according to national statistics, about 70% of accidents/crashes are due to the HF fault and 45% of them are due to the behaviour of the identified / guilty individual in critical situations. The remaining 30% of incidents can occur completely independently of the quality of production management practised and/or adopted by the organisation[1].

In those industries where there is a systematic, ongoing statistical monitoring of the types of incidents with victims and a proper accounting of the causes of accidents, emergencies and incidents, a favourable dynamic of both can be found. An example of the organisation's successful activity in this regard is the analysis of incidents in the Gazprom Mezhregiongaz Group for 2019-2023 (Figs. 1, 2, Table 1), which shows a convincing reduction in alarming indicators of safety, insecurity and well-being of the economic entity: by 81.35% in terms of accidents and by 46.79% in terms of incidents.

The transition to a fundamentally new qualitative level of solving the key socio-economic problems facing the Russian state in the third decade of the 21st century required the use of different analytical methods and modern instruments of socio-economic measurement. The main objective of such changes is to gradually move from factual registration at the end of a significant event to a comprehensive measurement of social, public and other risks associated with the impact of the HF on a significant event, forecasting the behaviour of risks over a given horizon and their timely prevention, without bringing either their predetermined nature or real, highly probable activity to the actual occurrence of an unfavourable event.

The best option for risk prevention seems to be the search for opportunities for extremely careful and sensitive management, since the overwhelming majority of organisations, in their current professional activities, encounter risks generated by the factor of human nature.

[1] https://srg-eco.ru/article/bezopasnost-rabotnika-na-predpriyatii-i-chelovecheskij-faktor/.

Moreover, due to the organic unreliability of individual employees, companies suffer losses that are much greater than those caused by occasional political and economic reasons, usually of external origin, and by circumstances of so-called force majeure (although, from the point of view of the interpretation of the current legislation of the Russian Federation, it is more correct to use the terms 'force majeure' or 'force majeure circumstances' instead of the term 'force majeure'[2]).

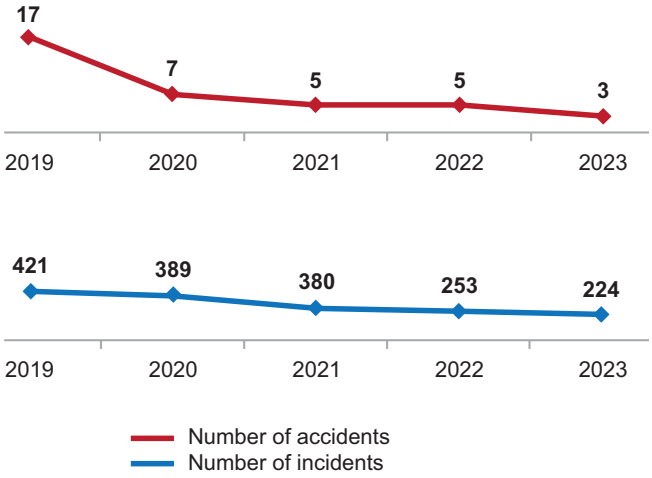
The authors of the article believe that risks of an obvious and implicit nature determined by the impact of the black field, act as the most significant threats to economic entities (hereinafter referred to as EE) that use live labour in their core business, i.e. have a purposefully selected temporary creative team and/or a permanent staff of industrial and production personnel, including engineering, technical and scientific workers.

Meanwhile, the continuous and dynamic development of the knowledge economy suggests that truly innovative organisations are faced with the most important but difficult task of recruiting appropriately qualified, preferably not only full-time, but also narrowly specialised freelancers to perform analytical, logical, intellectual, project-creative, expert, etc. work. Here, the significance of the presence of the risk of HF in the normal course of intellectual processes begins to noticeably exceed the role of the risks directly associated with the processes of physical labour in the conditions of automation, robotization, in the broadest sense of production processes in the conditions of using unmanned technologies of an achievable high level.

The role of living labour in developed market economies has relatively decreased, and the overall labour intensity of the production of an economic entity has decreased with the growth of labour productivity [Kolganov, Buzgalin, p. 265]. At the same time, with the increase in the complexity and impressive variety of available production technologies, the role of highly skilled labour has increased, and the quality of labour reproduction in accordance with the modern requirements of the labour market has improved, which in fact ensures the innovative and progressive development of any economy, and for the Russian economic system - the transition to a post-industrial society.

Such processes and phenomena as the transformation of science and the innovative economy into the main productive force of society, the increasing role of R&D, the widespread and large-scale introduction of the latest basic and advanced technologies, combined with the large-scale digitalisation of the main national economic processes, statistically indicate an increase in the share of purely creative activity in the creation of the final science-intensive product and, accordingly, in the level of added value.

Fig. 2. Statistics of accidents and incidents in dangerous production facilities of gas distribution organisations for the years 2019 to 2023



Source: compiled by the authors.

Accordingly, the demand for specialists with a high and the highest level of personal education and qualification increases, which, of course, requires the attraction of very significant target costs, which can be compensated to the global investor in the future both by directly increased returns from the application of the results of their labour in the sectors of the real economy [Ilyinskaya, 2010], and by contributions in other various aspects in the mode of an economic multiplier. It is precisely this phenomenon in its sequence of algorithms and operations that was reflected in the development of the concept of human potential formation, which was reincarnated in the list of categories of innovative production as human capital.

1.Clarification of the problem and the purpose of the research

This article examines the concepts of risk and uncertainty, their definitions, refined classifications of human risk, problems of risk comparison, methods of informational description of possible scales and metrics of hazards, predictive outcomes in statistics and dynamics, and, finally, approaches to the development of a system for measuring the risk of the human factor itself.

At the same time, the authors of the article propose the further development of a methodology for minimising the risk of the black field by selecting tools based on probabilistic assessments in relation to the conditions of those threats that create dangers for the harmonious balance of forces and actions usually included in the material complex of human behaviour. This or that content of the complex appears and is taken into account when justifying and making a final management decision in unclear situations that develop in conditions of

[2] Civil Code of the Russian Federation, Article 401. https://www.consultant.ru/document/cons_doc_LAW_5142/.

environmental uncertainty. In the most general form, uncertainty is understood as incomplete knowledge of the actual state of the studied, for example, socio-economic process, since analysts never have access to all the necessary information about the environment of the occurrence of the phenomenon and/or the course of the process.

According to the established opinion in the statistical community, the most consistent approach to the problem of accounting for uncertainty in solving optimisation problems is the probabilistic one - based on the frequency concept of the existing objective probability. The concept of objective mathematical probability in the axiomatics of Academician A.N. Kolmogorov, as a non-negative, σ-additive, normalised measure, is widely used in the construction of optimisation models that take into account uncertainty in relation to the predominant number of cases from the class of mass processes. However, the probabilistic properties of models can be successfully determined in non-mass cases, for which either methods of expert assessment or some inductive rules are used, operating both with the principles of entropy and with the principle of invariance. The already assessed uncertainty of the environment is subject to its proportionate reduction by reducing it to the original conditions of emergence and existence of risks, in particular from the group of black-field risks [Tsatsulin, Bykov, 2023, p. 127]. After all, if we analyse the environmental factors, both external and internal, it will quickly become clear that the behaviour of a certain person is explained by the state of the environment and/or the legal field, regulations, certain rules, which sometimes it is completely or partially impossible to convey information to this person [Hunt, Krivoshapka, 2020]. Therefore, it is necessary and important to create universal and specialised information bases and databases, which will allow, in particular, the so-called information diversification (see [Kordovich, 2008]) of factual and separate factorological arrays.

The clarification of such conditions of the environment of the existence of risks of personal characteristics and attempts to create methods of estimation of the effects of their impact on the activity of a certain organisation formed independent directions in many studies. Individual achievements allowed to improve the system of management of personal characteristics, i.e. personal characteristics themselves, in certain branches of the national economy, in certain enterprises. For example, the Russian consulting company SRG-ECO tried to develop an original method for measuring the human factor - Human Aspect in Labour Protection (HALP), known in the Russian version as the Diagnostic and Preventive System for Assessing the Human Factor[3]. The methodology has already been tested by experts in domestic companies and has received positive reviews on social networks and in the professional community.

However, in the comparatively narrow, limited and extremely specific field of the design of restoration and recovery works on immovable cultural heritage (ICH) objects, the authors of the article did not find any such specific studies. Nevertheless, the standards of behaviour in the organisation, the cultural and professional aspects of its core activities, undoubtedly affect the activity of the HF in the production of scientific and design works, which determined the purpose of this study, which is reduced to measuring the impact of HF risks on the efficiency of the analysed type of activity. Here, the authors understand HF as a structural component of the anthropogenic factor, influencing the modification not only of the environment, but also of the habitat of the person himself.

The article studies the assessment of complex damages and indirect losses, including a decrease in market activity and loss of business reputation of a specialised design organisation due to the negative impact of HF in the whole spectrum of its constituent elements on the results of professional, mainly creative activity. The subject of the study is the existing procedures and tools for measuring the impact of these risks in a multi-factor statistical analysis and modelling of business processes based on reliable baseline information.

Although the relevant specialists (statisticians, economists, sociologists, risk managers) recognise the usefulness of the above-mentioned diversification of information in research and, in essence, the intersection of various characteristics-factors in their sets, there are no clear indications in the literature reviews of the requirements and conditions of use under which the selected instruments reduce risks/threats and, consequently, the damage incurred. However, there are interesting sensational developments in the field. For example, analysts from the St. Petersburg administration calculated that the city's annual losses due to the implementation of climate risks amount to almost 786 billion roubles, and the number of independent risks of global climate change by type of detailed classification turned out to be no more and no less than seventeen[4].

There are also no universal, sufficiently reliable and convincing methods for measuring the impact of prescribed or recommended tools for reducing the probability of adverse outcomes based on the results of the organisation's project activities and/or analytical understanding of the depth of the risk situation, as well as risk sensitivity analysis and global risk analysis of the Black Sea Fleet during the final acceptance of the completed ONCH restoration project by the direct customer.

[3] https://srgroup.ru/.
[4] https://78.ru/news/2024-05-28/usherb-peterburgu-ot-izmeneniya-klimata-ocenivayut-v-780-mlrd-rublei-v-god.

2. Scientific elaboration of the research problem

In order to achieve the research objective and related tasks, it is necessary to identify the essence, to discover the sources, elements and properties that form the basis of concepts such as risk and uncertainty, since both the abundant scientific developments and materials, as well as the enviable wealth of pedagogical and methodological literature on risk management, contain interpretations of these terms and concepts that are characterised by their unfortunate ambiguity. Modern researchers of a topic that has been raised for quite some time, rather vaguely assume that risk is considered to be the flip side of freedom of choice, and the absence of a selectable alternative essentially also means the absence of any significant or even noticeable risk/threat of an unfavourable event occurring under conditions of environmental uncertainty that have not been fully clarified [Semerkova, 2005].

At the same time, in order to formulate a strategy for a particular choice in controversial conditions of uncertainty and as a basis for a management decision, the research literature traditionally recommends the use of probabilistic criteria by A. Wald, A. Hurwitz, L. Savage and others.[5] However, with regard to the uncertainty associated with HF and the predictability of human behaviour in a specific production situation, it should be understood that the most advanced corporate culture adopted by an organisation, based on correctly understood principles of freedom and responsibility, is of little value if employees do not bear personal, regulated responsibility for their erroneous actions for freedom, which has a certain price [Frantz, Rhoades, 1993]. It is here, in the opinion of the authors of this article, that the methodological sources of HF risk management can be found, particularly in a typical design and survey organisation.

The concept of risk is directly linked to measurable uncertainty and potential loss in the event of one or another economic, legal, social or other unfavourable outcome of an event. And if the category of 'event' is understood as a quantifiable result and sensory evidence of a specific test, then an event as a philosophical content reflects the category of 'the essence of the object/subject of scientific research' through the external forms of its existence. Under the quantitative result of the tests in general at different times and in different spaces of the general set of events (more precisely, its exhaustive set), dialectical logic and Marxist dialectics perceive and consider the canonical unity of the category 'essence' with another philosophical content called 'phenomenon' [Marx, Engels, 1962, p. 384]. It is fully consistent with the conceptual apparatus of epistemology [Lenin, 1974, p. 227] and does not contradict the philosophical approach to understanding the sources and postulates of the theory of knowledge of the postmodern era [Badiou, 2007].

Usually, the result of the realisation of risks for any phenomenon is an increase or decrease in some specific welfare, security and satisfaction of the owners or other economic agents who take these risks [Batanova, 2008, p. 127]. Thus, despite the fact that risk is a rather multifaceted entity and, of course, a multidimensional concept, something common to the definitions of various authors is the uncertainty in relation to one or another type of properly registered property from the point of view of legal and technical registration [Bulochnikov, Vinogradov, 2008, p. 146].

As a result, in view of the multifaceted and multidimensional nature of the risk of the HF, its final implementation comes down to the damage caused to the owner. Its scope covers the areas of activity on the production of goods, provision of services, consultations, implementation of socio-economic and scientific-technical developments and projects, design and engineering, forecasting, expert work on financial intermediation and commodity-money transactions [Bogatyrev, Tsatsulin, 2024, p. 174-193]. By taking risks, the owner or the hired manager (in any case, the person making the management decision, hereinafter referred to as the PMMD) still expects to make enough profit to receive the expected benefit. When investing in a project, the PM strives to obtain the benefit that covers the costs incurred/invested directly in the project [Tsatsulin, Bykov, 2023, p. 135].

In the search for means of safe operation of organisations, the so-called ALAPA principle (As Low As Practicably Achievable) was even formulated, according to which it is necessary to strive for the maximum theoretically possible safety, regardless of the cost. However, it turned out that such an approach, despite its attractiveness, is not scientific, since its consistent implementation leads directly to an increase in threats/dangers/risks with absolutely ineffective spending of target resources [Tretyakov, 1993, p. 17].

In fact, in addition to the direct risk that the measures themselves aim to reduce, there is a group of indirect risks caused by the specific characteristics of the ONCH and the restoration and construction works, as well as the equipment and materials available to the contractor and

[5] The Wald criterion (the so-called maximum, most cautious) is used by the decision maker when he chooses the option of an extremely pessimistic solution, without taking into account the risks; the strategy that guarantees the maximum profit under the worst conditions is accepted as optimal, which orients the statistics towards the most unfavourable conditions. The decision maker using the Savage criterion, in one way or another, takes into account the presence of a perfectly understandable risk, is guided by a more favourable development of the situation compared to its initial worst state, and chooses the strategy that provides for the prevention of excessive losses, which it can lead to. The Hurwitz criterion is used as a basis for the choice of the option in the most uncertain environment in the presence of all the risks considered in the preliminary analysis, for which a linear function of the pessimistic and optimistic outcome of the studied steady-state dynamic event is constructed [Kuznetsov et al., 1980; Savage, 1981, p. 432]. In any case, it is recommended to use several criteria, including the so-called combined Bayes-Laplace, Hodge-Lehmann, etc. criteria [Gorsky, Labsker, 2020].

the client, their operational characteristics, technologies, etc. Thus, the recognition that in a number of cases it is impossible or even inappropriate to achieve 'zero risk' (according to the ALAPA principle) has raised the problem of defining an acceptable level of risk or, in other words, of establishing a certain level of safety in the performance of design and survey work.

A number of suggestions were made, some of which were based on a comparison of the risks involved in implementing innovative technologies with the existing risks of technologies that were already updated at the time of implementation. The risk is considered acceptable if the innovation leads to a reduction in the overall risk. Other proposals have been reduced to a procedure for optimising safety costs, where the criterion of optimum is the minimum of total risk. This principle of ensuring the safety of activities is called ALARA (As Low As Reasonably Achievable), i.e. setting the level of safety of the organisation's operations as low as it can reasonably be achieved.

In recent years, a new direction in risk management has emerged, which is understood as a set of measures aimed at reducing the level of overall composite risk, i.e. the potential but always present material losses and other negative consequences of an incident in the broadest sense. The central concept in the risk management methodology is an incident/accident/error, which is recognised as inevitable and requires the development of protection systems to reduce its occurrence.

Accordingly, the subject of risk is the loss of various resources: mainly financial, labour, material, information, as well as the loss of business reputation, a threat to the image of the ES in the form of reputational risk, a decrease in the value of its brand and a decrease in its market activity. Thus, the amount of total losses can be correlated in one way or another with the measure of risk, which accordingly helps to determine its magnitude [Kas'yanenko, 2008, p. 184].

It is here, in this article (the first on the subject), that the authors believe it is necessary to quickly identify and adapt the tools that allow a proportionate reduction in the risks identified; in this case, the main tools for calculating the risk measure are sections of probability theory and mathematical statistics. Probabilities themselves, according to renowned experts in the field of artificial intelligence, 'are a way of accounting for the uncertainty that arises from economy of effort and lack of knowledge' [Russell, Norvig, 2006, p. 624]. In this case, it will be possible to express plausible judgments about the occurrence of a particular event with an established level of confidence/reliability and acceptable reliability.

The new institutional economic theory uses the term 'subjective risk', which is closest in meaning to the term 'human risk', as the tendency of individuals to behave opportunistically in the theory of modelling the mechanism of a commercial contract. Subjective risk is understood as the possibility that the insured will not take appropriate measures to reduce the probability of the insured event occurring within the term of the contract and will not be ready to take responsibility for the possible and various negative consequences of the mistakes made [Kashina, 2004].

At this point, we should avoid the fallacy of looking for the causes of the disease of irresponsibility exclusively in the character flaws of the organisation's employees, even though the term 'responsibility' itself has an understandable connotation of responsible behaviour. This leads to the realisation that any responsibility is represented by a certain behaviour in the form of specific actions that can be monitored and controlled. External control of an employee's feelings, thoughts, loyalty to the organisation, etc. is still fundamentally impossible. And if the head of an organisation really wants to create real responsibility among his employees, he must formulate the necessary and clear requirements for their behaviour [Smirnov, 2002].

3. Research methods and information base

The theoretical and methodological basis of the study was formed by the works of Russian and foreign scientists and specialists, who dealt with the issues of designing repair, construction and restoration works at the ONCH sites, and the associated risks related to HF. In order to obtain information on the parameters/indicators of risk accounting systems in Russian design and survey organisations, information banks and databases of data of interest were used, as well as reports from specialised related organisations engaged in the design of relevant work.

To solve the problems posed in this study, methods of materialistic dialectics, methods of inductive (probabilistic) logic, computational techniques of economic statistics, continuous and selective observation, methods of scenario approach, decision making, expert assessments, methods of financial and economic analysis and multifactor statistical modelling are used.

4. Research findings

The specific meaning of risky behaviour of an employee, a specialist of a design organisation in a given situation, and separately in the case of restoration works on the ONCH, is acquired by the execution of a contract concluded as a result of a tender for the performance of design and survey and restoration works of a construction and restoration nature, including the preparation of a feasibility study (hereinafter referred to as FES) of the project, project management, engineering services, etc. The need to use methods and tools that help take into account the risks and uncertainties associated

with decisions, which in most cases are significant [Kardanskaya, 2017], is increasing, especially in large organisations, where the principle of separating creative labour functions (not to be confused with the banal reduction of labour in mass, serial production) and creative operations in the process of making informed management decisions is widely applied.

Decision-making in a creative environment, i.e. any project work in an organisation with the ever-present so-called project risk, generally appears to be a holistic process, starting with the phase of recording the initial state of the analysed situation. This situation should always be perceived by the decision-makers as a significant deviation from the desired target state of the search environment, where the solution should be updated in accordance with the formulated goal setting, for example, in the performance of scientific and design work for the restoration and adaptation to modern use of immovable historical and cultural monuments of various levels of significance in the territory of St. Petersburg, the Leningrad region and the North-West region of Russia as a whole.

The specificity of the risks associated with the manifestation of HF, i.e. the usual behaviour of a person and the unusual actions of certain people acting as independent biological beings endowed with will and consciousness[6], is characterised by extreme diversity and natural complexity. Specificity includes first and foremost the biological characteristics of the human body, namely: susceptibility to disease, injury, age-related changes and old age, disability, dependence on outside help and other limitations of the individual. Such HF risks arise as an individual passes through the stages of his or her own life cycle, a sort of transient earthly valley of life, and can theoretically include a wide variety of phenomena associated with human life.

Thus, from a social engineering point of view, an individual's actions can be interpreted very broadly and include not only meaningful actions, but also physical reactions, body characteristics, involuntary actions, etc. Errors made by workers are to a large extent caused by psychophysiological limitations, such as reduced ability to perceive and process information, errors in management decisions, susceptibility to stress, fatigue, belonging to a risk group, including gambling addiction, which has recently taken on threatening proportions, emergent effects of actions, etc.[7]

The uncertainty that underlies the risks of cystic fibrosis is associated with the uncontrolled and sometimes aberrant behaviour of a particular individual in a particular, sometimes critical situation, where both the physical and mental components of the behaviour are simultaneously present and manifest. In the mental component, the so-called spiritual, conscious and unconscious processes usually occur. Depending on which of the above-mentioned components the sources of uncertainty in the environment in which the risks of HF are studied belong to, the latter can be classified as follows: physiological, behavioural, socio-public.

Physiological risks of cystic fibrosis are generated by causes, the implementation of which forms physiological reactions and properties of the organism of a specific individual, and these include such causes of dangerous events as poor vision, i.e. the inability of the eye to adapt to the instinctive physiological act of seeing[8], myopathy and myasthenia (muscle weakness), various diseases and health disorders, and finally, the cessation of all physiological processes in the body, i.e. death, the completion of the life cycle of an individual.

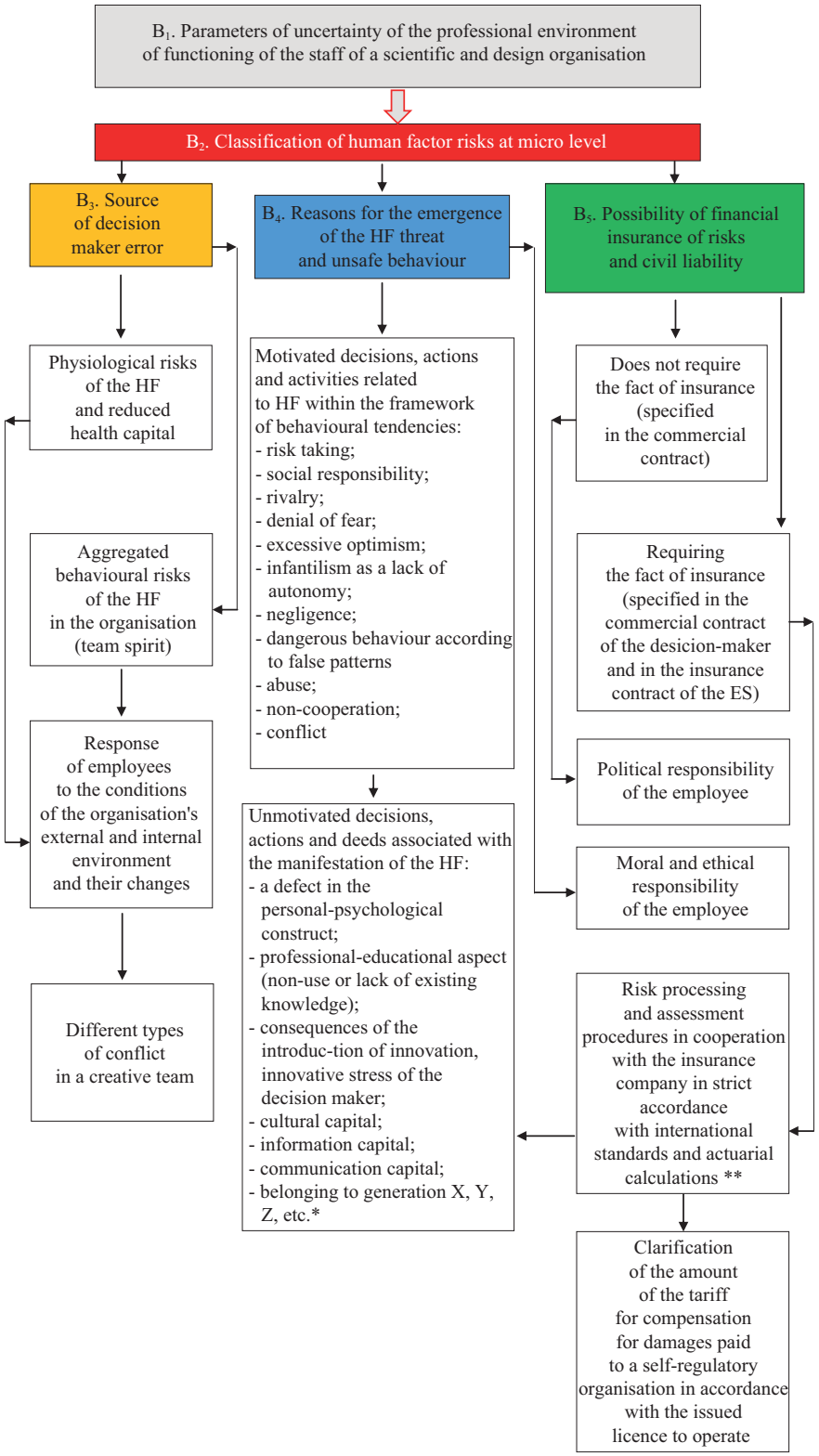
Behavioural risks of the HF, on the other hand, are the causes embodied in the decisions and actions of certain employees acting as independent decision-makers. Depending on the presence of will and awareness of consequences in the actions of employees, the subgroup of behavioural risks distinguishes decisions and actions as motivated, which can be established in the course of legal and technical procedures, and unmotivated, when the desicion maker performs actions that have undesirable consequences, including for the person himself. In this case, it is generally accepted that what happens is random in nature, has some stochastic distributions, and typical representatives of a certain group/category of causes (taking into account signs-factors acting as an independent variable) can be absent-mindedness, all kinds of miscalculations, errors and omissions of various kinds in work.

In addition to the biological characteristics of the behaviour of a particular desicion maker, it is necessary to separately identify a group of so-called socio-public risks directly associated with HF, which include the conditions of the functioning of the economic environment in the period under consideration, namely the general level of family income, the level of wages and the tax burden, the state of the labour market, the quality of the health care and social protection system, restrictions on access to socially accepted social standards, and even belonging to a certain age group of the population according to the Strauss-Howe generation theory [Howe, Strauss, 2008], recognised/accepted for Russian realities[9].

Most often, the risk category is defined as a potential danger or threat. However, the composition of the risk of HF, which is essentially socio-psychological in nature,

[6] https://allinsurance.kz/training-center/2012-06-28-04-04-26/upravlenie-riskom-risk-menedzh-ment/risk-menedzh-ment/1773-232-riski-svyazannye-s-chelovecheskim-faktorom.
[7] Identified consequences that the parties involved did not consciously seek in their actions.
[8] If normal vision is called proportionate or emmetropic, then the main types of human vision impairment are colour blindness, nearsightedness (myopia), farsightedness (hyperopia), astigmatism and some others.
[9] https://www.mirapolis.ru/blog/bumery-millenialy-i-zumery/.

Fig. 3. Classification of the risks associated with the impact of the Black Sea Fleet on the efficiency of the design and survey activities of a specialised organisation in the field of restoration works



* [Howe, Strauss, 2008].
** International standard ISO/IEC 27102:2019: Information security management – Guidelines for cyber-insurance ('Information Security Management: A Guide to Cyber Insurance'). http://rusrim.blogspot.com/2019/11/isoiec-271022019.html.

Source: compiled by the author.

includes several of its aspects. On the one hand, there is the risk of losses associated with the occurrence of unfavourable events in a person's life and, in our case, a desicion-maker as the first component. At the same time, the personal losses incurred by the desicion-makers and the organisation in which he or she works cannot always be compensated for by his or her income and, moreover, can be considered as missed opportunities for the comprehensive development of the desicion-maker's personality. On the other hand, the possibility of receiving any free transfer for persons who have a formal right to it, but which does not correspond to the true state of the recipient, becomes extremely illusory and is reduced to the second component.

The third component is the guarantee of the maximum set of social services necessary for the development of the individual and provided by the state, which contributes to the normal and safe functioning of society. The risk of not receiving/under-receiving the minimum set of social standards is accompanied by a limitation of opportunities for the full development of the individual. For example, lack of computer and financial literacy, systemic digitalisation skills, etc. limit access to information flows, which can be seen as a specific missed opportunity for individual development. At the same time, such risks may threaten not only the full development of a specific individual as a form of human capital, but also the security of the society and/or the economic unit at the micro level where this individual is employed - a specific unreliable employee, so to speak, belonging to a risk group. It is there that the requirements for the quality of human capital are assumed to be the highest.

The fourth component of the social and public risk of the HF is connected with the population's access to the reform of the system of social institutions functioning in society, a kind of natural selection and improvement of the best creative initiatives. This component is also related to the level of professional competences achieved by the population employed in the national economy, which is formed as a result of the education received at different times, the acquisition of specialised knowledge, skills, abilities and skills during retraining, further training, etc., as well as the previous presence of the individual in a specific social environment and his/her background.

The taxonomy of HF risk itself should be understood as the distribution of risk into specific classification groups according to certain characteristics and factors for the detailed formulation and achievement of the goals set. The main thing here is to maintain the purity and stability of the classification feature-factor with previously adopted criteria for conducting typological statistical grouping. When constructing possible classifications of human risks, the block principle can be applied, which assumes the distribution of human risk components by categories, types and subtypes, groups, subgroups, families and other levels.

The classification can be built on different principles and bases, for example: general (unified) and specific (block), according to industrial and regional criteria, with or without the use of any summary characteristics in the form of an index, indicator, etc., but necessarily with the parameterisation of the habitat of the analysed micro-level organisation, as shown in block B_1 in Figure 3. The process of detailing the classification of risks according to the block principle from the human factors point of view is shown rather schematically in the figure, and the synthesis and/or detailing of blocks, if necessary, will not be difficult at any stage of a detailed study of the nature of human factors risks.

In the activities of specialised design and survey organisations, the analysis of the issue of sources and causes (signs-factors) determining the existence of human capital risk is of the greatest practical importance. Personal and psychological factors of HF risk, indicated in block B_4 for the group of unmotivated actions and deeds in Fig. 3, which also determine the market competitiveness of HF on the labour market, play an increasingly important role at the micro level of the economy in modern production-economic and financial-sales activities of the ES.

Personality traits such as discipline, energy, businesslike attitude, as well as sociability, ability to respond to external influences and other characteristics of an individual act as an important aggregate factor in the efficiency of the use of human capital, especially in knowledge-intensive industries of the real sector of the economy and in the service sector. At the same time, the theoretical significance of the results of statistical analysis of related sectors of the array of factorological material is in no way diminished.

Contact with rapidly changing and constantly updated conditions of the external and internal environment, which the decision maker often does not have time to foresee and is not ready to understand, forces him to make decisions on new situations and tasks under time pressure. It leads him to a serious psychological problem in the form of phobias - fear of any change and fear of making a wrong decision. Phobias, in turn, greatly reduce not only the capacity of personal memory, but also the operational and technical level of the individual's intellect as a whole.

In the decoding of the positions of block B_4 in Figure 3, there is also a factor of imputed innovativeness, which requires due comment, since the modern vision of the concept of psychological stress allows us to consider innovative moments as one of the factors of neurosis. In addition, any novelty can be interpreted as stress, which suggests the formation of one or another neurosis, since there are at least two isolated sign factors involved - the

reaction of the individual at the mental level and the reaction of the body LPUR at the physiological level.

Depending on the strength and duration of the innovative influences, the combination of the individual's reaction to the decision maker and the development of compensatory mechanisms of its adaptation, stress as a product of the influence of the innovative factor can acquire either a mobilising or a destructive and painful character. The latter type is known in psychological literature as stress/distress [Cheprasov, 2011, p. 50], which requires the detection and identification of such a threat, the vulnerability of the decision maker and the implementation of appropriate measures in block B_5 in Fig. 3.

One of the main approaches in the theory of innovative neuroses is to consider innovative stress (social and public conflicts, changes in the external and internal environment, crisis phenomena, etc.) as a phenomenon leading to the emergence of various types of psychological conflict [Shcherbatykh, 2012]. For a decision maker, the introduction of new equipment, innovative technologies (especially basic ones), materials and services usually means the need to abandon the state of habitual perception, the 'good old' meme, a change in long-established but somewhat outdated public and social ideas, established professional relationships and a clip of communicated contacts.

Innovations imposed 'from above' often provoke overt or covert resistance, sometimes even a hostile reaction from the professional environment to the somewhile aggressive onslaught of innovation. Even in the case of consensus, its implementation is accompanied by latent conflict as it forces staff to adapt to mandatory and regulatory changes. Consequently, conflict can also be considered as an objective source of the emergence of HF risk and as an independent sign factor that necessarily accompanies innovation processes.

Personal-psychological and communicative factors of human risk are directly related to social-production relations and conflicts of interest between people. They find their solution in the form of overcoming the conflict according to the established canons of classical conflictology, with the emergence of new conflicts of interest and new social and industrial relations, manifested in such a quality of human nature as self-reflection. In other words, the analysis of an individual's responsible behaviour and inner world is carried out in order to resolve deep inner problems, torment and to find ways of further self-development. This specific quality of HF, as noted, for example, in [Ushanov, 2011], turns out to be the basis that serves as a foundation for the development of a complex of relations between the subject and object of management with the aim of adapting the latter to the challenges of external and internal changes.

The phobia of making a wrong, erroneous decision due to time constraints, i.e. strict design deadlines, coexists in block B_4 in Fig. 3 with the information overload of the decision maker, which implies a lack of understanding of the responsibility that a key employee of an organisation performing scientific and design work imposes on himself, according to the positions of professional and functional instructions, as well as the departmental methodological recommendations[10].

Those who cannot cope with the increased speed of decision making begin to show symptoms of fear of the manifestation of unknown direct, indirect and associated risks, and the actual fear of action forces them to slow down the process of making a particular management, engineering or technical decision. In such a psychosomatic context, tendencies towards persistent resistance to more or less significant changes begin to manifest themselves. Such behaviour of an individual on the Internet and in the perception of information is currently being seriously studied by specialists in the field of risk management.

The targeted collection of information necessary for the study of risks of various kinds requires the solution of a whole range of methodological problems and issues in the creation of an information system for measuring, comparing, analysing and forecasting social and public risks at various levels of management. All this is possible within the framework of departmental statistics, provided that there is a regular interdepartmental exchange of information. The lack of a theoretical basis and an established, generally accepted system of technical, economic and other indicators not only complicates the formation of both, but also hinders interdepartmental analysis in the mode of the above-mentioned diversification of information.

The integrated, interconnected use of information from different departments opens up favourable prospects for thorough, comprehensive and, above all, justified measurement using a single methodology and interdepartmental comparisons of the HF risk system, for example during design and survey work, where significant risk tensions are observed. Only then will there be a prospect of developing and subsequently implementing some kind of integrated risk management system.

There are three possible approaches to the integration of interdepartmental information, which are implemented on the basis of:

– an individual approach to the analysis of the activities of a specific scientific and design organisation, i.e. the identification of employees with low indicators in the broad sense of reliability;

[10] RNiP-4.05.01-93. Methodological recommendations for estimation of costs of scientific and design works for restoration of historical and cultural monuments. Moscow, 1992.

– study of the composition of restoration, construction and other works carried out by the scientific and design organisation;
– the results of the analysis of the personal skills and human capital of performers in specific jobs, which will allow us to identify areas for the development of personal characteristics in the areas of communication, emotional intelligence, stress resistance and other individual qualities.

5. Discussion

An error prevention system is more effective if it focuses not so much on quality control of products and/or services, but on quality control of production processes and/or delivery of integrated services, business processes and their prioritisation. Accumulated statistics show that despite constant efforts to improve the security of, for example, large and small companies, the majority of incidents are due to the functional unreliability of a person. Therefore, today the main emphasis in prevention and protection against HF risks should be placed on the protection of employees from mistakes, according to some researchers [Olinovich, 2010], and the authors of this article agree with this opinion.

From the conceptual positions of social engineering, methodological and instrumental tasks of threat analysis, socio-public risk is understood as the probability of the occurrence of events that threaten the normal reproduction of human capital, the physiological and socio-economic life of an individual and belonging to a generation of a specific age group of the population. Thus, according to Rosstat, the X generation (born 1967-1984) makes up 28.7% of the country's total population, the Y generation (or millennials, born 1984-2000) - 20.5%, and the Z generation (or zoomers, born 2000-2015) - 16.3%[11]. It is these three groups, out of six that have emerged and that sociologists have observed, that make up the majority of applicants for a particular position in the organisation.

The differences in the worldviews and backgrounds of the X, Y and Z generations, which are the source of the threats (see B_4 in Fig. 3), can be extremely useful both in the search for new non-trivial solutions to routine problems and in the implementation of fundamental innovations in an organisation. It has been shown that in game and practical Brain Storming situations, the participation of representatives of all three generations in a single team leads to a higher quality management decision and produces a better result than a mono-team with representatives of only one generation. An employer who recognises the benefits of age diversity in his workforce may find himself in an advantageous position.

General criteria of social and public risk usually include the following: probability - frequency (f - frequency), frequence (φ - RF, frequence) - of occurrence of a risk situation; duration of a risk situation, i.e. the period between its occurrence and transition to normal, usual conditions of life of an individual, economic entity, other object of study; level of social guarantees in case of occurrence of a risk situation; level of material security before occurrence of a risk situation; amount of personal contribution to creation and realisation of a risk situation; amount of personal contribution to creation of insurance funds and reimbursement of full or partial damage from the position of the insurer[12].

Moreover, paradoxical as it may seem, the desire to completely eliminate the risk of a normal, rational, logical and reasonable person making a mistake for various reasons seems to be an unjustified whim in certain areas of creative and intellectual activity. And here one cannot but agree with the statement from the famous work: 'A wise man is not a man who does not make mistakes. Such people do not exist and cannot exist. A clever person is one who makes mistakes, not very important ones, and who can and knows how to correct them easily and quickly'. [Lenin, 1981, p. 86].

However, the human brain, as a unique information neural network, is so complex, and the algorithms of human behaviour, as a product of a progressive thought process, so unpredictable, that an individual's actions can often turn out to be simply irrational, so it is not only possible to correct mistakes, but one should definitely learn from them.

The representatives of the philosophical school of the cynics have left us with the humorous maxim that one's own experience helps to avoid repeating mistakes for the seventh time. In the concepts of innovation policy that are currently being implemented everywhere, the so-called trial-and-error method is one of the key aspects. The best practices of domestic and foreign IT companies and the successful experience of transforming their market business in highly competitive conditions show that in truly innovative environments, which require the presence of the highest creative potential, each individual is allowed to make mistakes of a certain severity.

Conclusions

On the basis of the material in this article, five rather brief interim conclusions can be drawn about research.

1. In everyday scientific, design, engineering, etc. activities, the decision maker, when making all sorts of decisions in an insufficiently defined production

[11] https://www.mirapolis.ru/blog/bumery-millenialy-i-zumery/.
[12] Yukaeva V.S., Zubareva E.V., Chuvikova V.V. (2016). Making Management Decisions: Textbook. Moscow: Dashkov i K, 216.

environment, may also be confronted with the uncertainty of the consequences of its sometimes erroneous actions in the mode of already occurred risks. A meaningful explanation of the multidimensional matrix of such uncertainty, the study of unknown state spaces, their essential content and a reliable measurement of the multiplicity of risks, as the authors of the article believe, will be possible if the methodology of inductive logic is always applied. The latter has adopted the modern form of probabilistic logic, supported by qualitative measurement tools such as Instrumental Variables (IV) and other statistical techniques and methods.

2. Correction of changes in the behaviour of the decision maker in a design and survey organisation in the field of design of restoration and construction works is possible if a number of requirements are met, in particular, reduction of direct mistakes and errors, the proportion of which, even in a regulated stable management system, reaches 5-10%. Given the absolute impossibility of completely eliminating them in the daily activities of the creative industries, a reduction in the level of errors is possible by moving to controlled/supervised regulations for the automated development of projects and technologies, with strict adherence to a risk-centred approach aimed at minimising the foreseeable direct and indirect types of damage. The latter must necessarily entail a proportionate reduction in the level of tariffs transferred to the industry's self-regulatory organisation.

3. It is impossible to develop an integrated system for measuring HF risks and the technology for managing them in a research and design organisation without a deep and fundamental understanding of the causes of human behaviour and a comprehensive assessment of the seriousness of any erroneous actions of the decision maker, an adequate assessment of the perception of the essence of these risks. Otherwise, each ES will involuntarily form its own additional risks of a professional nature, assortment and nomenclature characteristics and related features of the ES's presence in the industrial market environment.

4. Special attention should be paid to the possibility of preventing the occurrence of erroneous decisions in scientific design works, the implementation of which will, in one way or another, be connected with the expansion of the scope of application of artificial intelligence and robotics technologies from the realm of creative design possibilities. In this case, it is unproductive to shy away from the accumulated foreign experience in solving the identified problems, and the ES must focus on transforming the research and design organisation into a platform for advanced development and, accordingly, qualified solution based on verified statistics of the threat-metric complex of narrow professional problems of the ES operating in the restoration works market of the ONCH.

5. Finally, the authors of the article strongly recommend that developers of advanced innovative and digital technologies pay particular attention to the supposedly risk-free behavioural algorithms of robotic performers, which are being created everywhere with the help of artificial intelligence. Such essentially neural network algorithms can, of course, in most cases turn out to be congruent with basic anthropomorphism, which suffers from vulnerability, insecurity and a tendency to misbehave. These concerns are justified in the context of the reports that have appeared about the successes of some domestic scientific centres in creating models of neuromorphic microelectronics, in which basic integrated circuits and neuromorphic processes replicate the structures of the human brain and in some ways coincide with it. And although the seemingly controversial achievements of neuromorphic engineering have long been known, the mysteries of the human brain have not yet been fully unravelled, and therefore the HF errors cannot be eradicated.

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