Features of risk management in the construction industry in a pandemic with limited use of transport

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Abstract. The article highlights the main risks faced by construction companies in a pandemic with limited use of transport. At the same time, one of the significant leaps in the development of companies is updating information technologies that require a new approach with limited possible information transfer between employees. So an important factor in the impact of crisis is the work of office workers on remote access. The article presents the testing of proposed recommendations for evaluating workers in terms of reliability and risk tolerance in a construction company. The results of testing recommendations reflect the possibility or need to restrict access to important documents of company's internal information environment.

1. Introduction

The spread of COVID-19 throughout the world has led to the inevitable sad consequences of development of almost all sectors of the economy. So the global pandemic has brought following risks to Russian construction business:

1) restriction of work in quarantine zones;
2) insufficiency or absence of suppliers and contractors (we are talking about the supply of building materials, consumables, components, etc.). This is especially important when it comes to large investment projects;
3) difficulty of finding and attracting new personnel and advanced training of existing employees;
4) risk of diversification of suppliers if, for a known reason, they do not cope with the concluded contract or cannot fulfill it within the agreed time frame;
5) errors in the calculation and construction of logistics chains, both for the supply of raw materials, and for the transportation of materials to construction sites. In addition, risk of insufficiently effective pricing and marketing policies of the company may be added here;
6) occurrence of information leakage due to work on remote computers;
7) break or complete stop of construction and installation works at many investment projects;
8) risk of concluding agreements with insolvent partners or with partners on the verge of bankruptcy;
9) slowdown of staff in connection with the departure of office workers to a remote format;
10) and much more.

These consequences inevitably affected the deficit in revenue and working capital of almost all construction companies, so necessary in current conditions to pay direct mandatory costs: wages, rents, taxes, loans.

It should be noted that in the near future the number of bankruptcies and non-payments in the construction sector will increase. The main thing in this situation is to maintain financial independence and look for new opportunities and niches for the long-term development strategy of the company.

It is important to note that in most countries governments take anti-crisis measures to minimize the impact of the coronavirus pandemic on the construction industry, as it is directly related to the stability of the economy as a whole. So, in Russia, restrictions on the construction business are minimized and the amount of subsidies to support housing construction and infrastructure has been increased. At the same time, security measures at construction sites have been tightened to fight the spread of the disease. In particular, it is recommended that foreign citizens employed in construction refuse to travel. This affected the timing and cost of the work in connection with reduction of cheap labor from neighboring countries.

At the beginning of July 2020, about 99.5 million square meters are under construction with the involvement of citizens of Russian Federation, and projects financing using escrow accounts make 35% of this volume. This suggests that many housing projects being built in Russia as part of project financing using escrow accounts have stopped due to the pandemic situation.

To support the construction industry in a crisis, according to the instructions of President of Russian Federation, Government of Russian Federation adopted a state program of concessional lending to construction companies that are developers. Thus, the total living area of facilities built at the expense of loans with an approved preferential rate at the beginning of July 2020 amounted to more than 10 million square meters.

It should be noted that one of the important changes in the construction business in connection with the current situation in Russia and the world has been the active introduction of information technology.

For buyers of real estate, online technologies for the purchase of apartments have been developed and technically implemented. The whole process, from choosing a property on the website of a development company and its price reservation to paying and registering a transaction in Rosreestr, can be carried out by the buyer in his personal account on the official website of the development company or, if available, using a mobile application. Thanks to the electronic signature, the contract of sale can be signed at home, and payment is made through an individual Internet link sent by the developer by e-mail.

However, despite the sharp jump in scientific and technological progress in the field of online technologies due to quarantine, most companies were faced with the problem of impossibility of further use of the information system for making managerial decisions applied within the company until the crisis of 2020. This is due to the following reasons:

- limited data transfer between office workers, significantly remote from each other;
- poor equipment of employee’s desktop and computer at home;
- limited access or prohibition of the use of certain internal electronic documents for some employees;
- risk of information leakage to competitors from dishonest employees.

To solve these problems, some companies are reviewing existing management decision-making system, with the main emphasis on the personnel-information interaction.

Issues related to risk were considered in works of such scientists as B.Kh. Aliev, A.P. Arkhipov, N. B. Grishchenko, A. G. Ivasenko, Ya. I. Nikonova, B. A. Raizberg, L. Sh. Lozovsky, E. B. Starodubtseva, E.F. Dyuzhikov, A.I. Khudyakov, G.V. Chernova, V.V. Shakhov, A.S. Shapkin, V.A. Shapkin, A.K. Shikhov and many others [1,2,3,5].
2. Methods

In a pandemic, there is a rapid development of globalization and innovation, and the use of information technology is considered as a fundamental tool for the effective work of construction companies in the current risk environment, which allows using various opportunities to increase their competitiveness.

Information technology, which is the key to the success of modern business, is constantly being improved, especially in current conditions - in the field of automated information systems and technical means of communication. In this regard, the task arises of their implementation, modernization and search for new, effective areas of their practical application during a pandemic. Moreover, these steps are aimed at improving the information system for making managerial decisions in a construction company in an environment where office workers and management perform work on remote access.

Formation of an information system for making managerial decisions is based on the following conditions:
- application of scientific basis in the development and implementation of management decisions using modern technical tools;
- consistency in the development, adoption and implementation of management decisions using informatization and automation;
- multivariate, integrated approach to the choice of entrepreneurial decisions;
- presence of well-structured methods of documentation and reporting, as a basis for the development of future solutions;
- use of intellectual, informational and calculated forms of work.

The most important component in the process of improving information systems is assessment of already taken actions to ensure technical protection against risks using information technologies, as well as forecasting future results. At the same time, the increasing role of information factor should be noted, both at the stage of identifying risk, and at all subsequent stages, up to its minimization or elimination [4].

In order for the management decision-making information system to work effectively, it is necessary that two basic conditions are met:
- presence of high-performance computer equipment with elements of artificial intelligence;
- presence of highly qualified, trained personnel (primarily IT specialists and risk managers). So, in the labor market during the pandemic, there is an active demand for system administrators and programmers, including developers of mobile applications.

This implies significant financial costs and sufficient time spent on the creation, implementation and maintenance of such a system. However, the most important here are workers and their human capital. Without this, it is impossible to organize the effective use of expensive equipment and its tuning to solve such complex issues as minimizing and eliminating risks.

Fundamental feature of working with risks is the amount of information that every employee gets access to, depending on his status and membership in a hierarchical level of management. This actualizes such a problem as trust and dosing of information, especially one whose leak can lead to serious problems, up to the complete collapse of the company. Therefore, the entire amount of information must be distributed among employees and to regulate their contacts with each other. At the same time, threats also arise from the side of computer technology, which, unfortunately, is currently increasingly being subjected to "hacks". In addition, individual office workers can receive the "excess" amount of information in the remote work mode at the computer. This requires additional costs for security, access control and creation of backup information storages.

In this regard, an effective organization of work with personnel is necessary, starting from the stage of its selection by categories of line workers and managers at various levels. This is important for medium and, especially, small companies where all employees, one way or another, contact each other via personal phones.

The structure of risks that may be caused by company personnel is proposed to be presented in the
form of an abstract model (Figure 1) [6].

![Abstract Model of Risk Formation](image)

**Figure 1.** Abstract model of risk formation as a result of actions / inaction of personnel.

Analysis of the structural elements presented in this figure will begin with the most problematic blocks, namely, with the block of employees who have access to the company's internal information, which can provoke risk. In this case, such employees can be considered as risk carriers, which involves the development of a model of managerial behavior that allows not only to control this process, but also to reduce the risk of risk arising here. As noted above, this is especially important in the context of the increasing importance of information technology in the work of any company, which is a reflection of the process of globalization and scientific and technological progress. Based on the fact that in the hands of certain employees, including those involved in servicing information resources, a huge amount of information is concentrated, access to important information about the work of the company is obtained not only by owners and key managers. This creates additional internal risks for the company, based on the fact that employees can dispose of this knowledge to its detriment. Due to the specifics of information resources, events can develop according to a negative scenario even in the absence of intent on the part of employees. In this regard, there is perhaps only one way to reduce risk - decomposition of information that is concentrated among key employees, as well as regulation of access to technical means of working with the most important information, including its receipt, processing, storage, transmission, protection, etc.

For this, it is proposed to use a management model of working with information and personnel with access to it. This model is based on a diversified approach to managing personnel working with information, the loss of which will lead to risks for this company. Formalization of this model requires a system analysis and use of the well-established method of expert assessments. First of all, experts determine the probability of occurrence of certain risk events that may be caused by the actions or omissions of their own personnel (both containing and not containing intent), classifying them according to different risk assessment criteria.

Following sequence of actions is suggested:

First step. Information is revealed and classified, the loss of which can create a risk in relation to the company. Information can be classified by its importance, duration (relevance), types of risks associated with it, etc.

Second step. For each of the information groups identified as part of the classification, the
probability of risk formation in relation to the company under study is calculated. As part of this, an expert assessment of information is carried out, the loss of which can lead to risky events.

\[ R_j = (R_1, R_2, ..., R_n); \quad Q_j = (Q_1, Q_2, ..., Q_n), \]  

(1)

R - type of risk (risk event); Q - magnitude of the risk (its quantitative assessment); j - information, the loss of which may lead to risk; n - is the number of information blocks constituting a risk.

Third step. Possible level of negative consequences of risk is determined.

\[ P_j = \sum_{n=1}^{d} R_j Q_j, \]  

(2)

P - is the estimated scale of the impact of risk; d - is the limit (maximum) value of the information blocks constituting the risk.

Fourth step. Information is determined (including technical means on which it is stored, transmitted and used) for its ranking from the position of determining the most important for protection.

Fifth step. A system of measures to protect information is being developed.

Sixth step. The system of measures for protection is analyzed, and a roadmap is developed for their implementation as part of a systematic work that combines clearly defined tasks, tools, implementation costs, those responsible, and a system for evaluating the results.

If the constructed roadmap does not satisfy the management of the company, it is necessary to return to the second step of this sequence of management activities.

In addition, we should once again draw attention to the importance of quality of managerial work with employees who carry information or those who provide technical support. All this work begins with the selection of personnel, but should not be limited to this. Important in this case is the formation of a team that is morally, materially and professionally interested in the development of the company and its effective work. Otherwise, it will not be possible to ensure a high-quality information protection mechanism, and it will be necessary to confine to crushing the entire amount of information into elements that individually cannot pose a serious risk if they are lost. Close attention needs to be paid to contacts, both formal and informal, between employees with access to information. It is necessary to maintain a reasonable balance between restriction of such contacts and development of an intra-organizational communication system, which is the key to a favorable socio-psychological climate. Excessive restrictions can adversely affect the development of the company, as it impedes the formation of a healthy, efficiently working team.

Nevertheless, when solving problems in the field of working with risks, requirements for personnel and their assessment increase. In this regard, it is proposed to carry out managerial actions to evaluate employees, both during their selection during employment and in monitoring the effectiveness of their work (table 1).

**Table 1.** Assessment of employee in terms of reliability and risk tolerance.

| Group of estimated indicators | Indicators of reliability and stability of workers | Rating symbol \( C_i^j \) | Coefficient of significance of the assessment \( k_i^j \) |
|------------------------------|-----------------------------------------------|-----------------|-----------------|
| Professional qualities | Level of education and qualification appropriate to job responsibilities | \( C_1^1 \) | \( k_1^1 \) |
| | Presence of special knowledge, skills appropriate to the position and field of activity | \( C_2^1 \) | \( k_2^1 \) |
| | Knowledge of the order of the company and the practical implementation of business processes | \( C_3^1 \) | \( k_3^1 \) |
| | Experience in this field and job performance | \( C_4^1 \) | \( k_4^1 \) |
| | Skills for business and professional contacts | \( C_5^1 \) | \( k_5^1 \) |
| | Combination of rigidity and willingness to compromise | \( C_6^1 \) | \( k_6^1 \) |
| | Ability to carry high loads | \( C_7^1 \) | \( k_7^1 \) |
Results of the assessment are summarized, taking into account previously assigned coefficients of significance of professional and personal qualities.

\[ W = k_1^j \sum_i^7 C_i^j + k_2^j \sum_i^7 C_i^j, \]  
(3)

W - cumulative assessment of the quality of the applicant or employee, his risk tolerance and reliability; k - significance coefficients (calculated by expert estimates).

The proposed assessment should be carried out for each group of workers and provide for more detailed detailing - by position or even by specific employee. In addition, one can even envisage an extension of the assessment, including following gradation: intern - employee - experienced employee - mentor. At the same time, in large companies, assessment will be carried out by personnel groups..

3. Results

For clarity of the proposed assessment methodology, it was tested in a construction company performing construction and installation works in the Tyumen region in Russia.

The experts for setting the significance factors were: director of the company, chief engineer, head of the planning and economic department, chief accountant, head of the warehouse.

Assessment was conducted for office employees of the company directly admitted to commercial information and having an electronic signature. These employees have been assigned an identification number from 1 to 16.

**Table 2.** Results of the assessment of construction company workers in terms of reliability and risk tolerance.

| Group of estimated indicators | Expert assessment of employees $C_i^j * k_1^j$ |
|------------------------------|-----------------------------------------------|
|                              | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   |
| Professional qualities       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 0.75                         | 0.09 | 0.5  | 0.2  | 0.4  | 0.2  | 0.2  | 0.5  | 0.7  | 0.2  | 0.5  | 0.6  | 0.25 | 0.35 |      |      |      |
| 0.1                          | 0.1  | 0.05 | 0.25 | 0.5  | 0.4  | 0.55 | 0.35 | 0.1  | 0.2  | 0.25 | 0.3  | 0.05 | 0.45 |      |      |      |
| 0.3                          | 0.1  | 0.8  | 0.15 | 0.25 | 0.35 | 0.15 | 0.1  | 0.3  | 0.2  | 0.15 | 0.05 | 0.75 | 0.5  | 0.1  |      |      |
| 0.6                          | 0.5  | 0.45 | 0.4  | 0.25 | 0.15 | 0.25 | 0.1  | 0.05 | 0.1  | 0.05 | 0.85 | 0.09 | 0.15 | 0.05 |      |      |
| 0.55                         | 0.75 | 0.05 | 0.35 | 0.75 | 0.35 | 0.35 | 0.75 | 0.15 | 0.1  | 0.75 | 0.2  | 0.4  | 0.6  | 0.7  | 0.6  |      |
| 0.85                         | 0.1  | 0.15 | 0.6  | 0.2  | 0.09 | 0.2  | 0.05 | 0.05 | 0.25 | 0.1  | 0.45 | 0.15 | 0.2  | 0.25 |      |      |
| 0.15                         | 0.05 | 0.15 | 0.35 | 0.1  | 0.35 | 0.2  | 0.15 | 0.1  | 0.05 | 0.8  | 0.5  | 0.15 | 0.25 | 0.2  | 0.4  |      |
| 0.3                          | 0.05 | 0.5  | 0.55 | 0.05 | 0.05 | 0.4  | 0.8  | 0.05 | 0.45 | 0.5  | 0.4  | 0.1  | 0.8  | 0.75 | 0.55 |      |
| 0.8                          | 0.4  | 0.09 | 0.35 | 0.8  | 0.6  | 0.5  | 0.35 | 0.4  | 0.45 | 0.1  | 0.3  | 0.55 | 0.2  | 0.15 | 0.25 |      |
| 0.45                         | 0.35 | 0.55 | 0.1  | 0.3  | 0.1  | 0.45 | 0.6  | 0.6  | 0.05 | 0.6  | 0.35 | 0.1  | 0.05 | 0.6  | 0.8  |      |
| 0.1                          | 0.05 | 0.25 | 0.35 | 0.2  | 0.2  | 0.45 | 0.2  | 0.85 | 0.05 | 0.75 | 0.85 | 0.2  | 0.1  | 0.1  | 0.45 |      |
| 0.2                          | 0.55 | 0.15 | 0.75 | 0.25 | 0.85 | 0.35 | 0.1  | 0.15 | 0.15 | 0.15 | 0.09 | 0.35 | 0.45 | 0.5  | 0.3  |      |
| 0.25                         | 0.1  | 0.35 | 0.6  | 0.15 | 0.15 | 0.35 | 0.2  | 0.05 | 0.1  | 0.3  | 0.35 | 0.05 | 0.25 | 0.75 |      |      |
| 0.09                         | 0.45 | 0.2  | 0.35 | 0.2  | 0.35 | 0.6  | 0.2  | 0.4  | 0.09 | 0.25 | 0.1  | 0.15 | 0.09 | 0.1  | 0.15 |      |
Thus, in spite of the fact that almost all office employees of the studied construction company are admitted to important documents of the internal information environment, it is recommended to establish certain access restrictions for such employees as 4, 5, 12. This is due to the lack of conformity of professional and personal qualities, which can negatively manifest itself in a crisis. However, when implementing the proposed recommendations, it is necessary to note the advisability of “soft” inconspicuous excommunication of employees from certain internal information so as not to show rudeness and doubt in their competence.

4. Discussions
Thus, based on the trend of increasing costs for informatization of companies in the field of risks, recommendations are proposed for improving managerial decisions aimed at minimizing risks, in particular, assessing employees in terms of their reliability and risk tolerance. Given the expansion of conditions under quarantine, under which the work of personnel may provoke new risks or increase the influence of existing ones, directions of work with various groups of personnel are indicated. Particular attention is paid to employees directly related to the use and maintenance of computer equipment, databases and information transfer media, which constitutes an increased risk zone for the company.

5. Recommendations
Article materials are important for company leaders in substantiating management decisions to improve the information system within the company, as well as for risk managers in formulating a company development program in a crisis.

References
[1] Aliev B Kh 2011 Insurance 415
[2] Arkhipov A P 2012 Insurance 288
[3] Kondratiev V V 2010 Organization of energy conservation (energy management) p 108
[4] Didushkova M, Votapek M Portal-energo http://portal-energo.ru/files/articles/portal-energo_ru_chehiya.docx
[5] Kapustina N V 2012 Economics 11 48
[6] Leiman N I 2011 Education Advisor 1 52
[7] Chapaev A B, Bozieva Yu G 2015 The online journal Science of Science 5(30) 1
[8] Lapenok B S 2011 Energy conservation in practice: tasks, products, solutions 9 40