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Express Diagnostic Model of Crisis Preparedness

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Abstract

The problems of the theoretical content of anti-crisis management, sustainability and business continuity demonstrate their relevance for the management of Russian and international companies of various levels and scales in the lockdown of 2020. In conditions of instability of economic systems at various phases of economic cyclicality, signs of readiness or unpreparedness of an organization to reflect various kinds of incidents appear. The formation of an organization's culture of Incident preparedness and operational continuity management (IPOCM) can be viewed as a type of intangible asset that contributes to the growth of management quality. The existing multivariate models for assessing the financial condition of a company are based on accounting for tangible assets and determine the signs of an organization's insolvency, the signals of which can be seen at an earlier date. In this direction, for the first time, a multifactor model for diagnosing an organization's readiness for crisis situations is proposed to determine the degree of continuity of the organization's functioning, which is determined through the correspondence to the values of the organization's readiness for incidents. Crisis situations are viewed as a multitude of incidents, the readiness for which is demonstrated by enterprises in different sectors of the economy in different ways. Crisis situations are accompanied by certain signals, which, according to numerous observations, it is advisable to translate into the format of factors. In the course of a special study on the problem of organizations' preparedness for a crisis, non-financial factors were identified that ensure a certain degree of continuity of the organization's functioning. One of the key factors in an adequate incident response is the time factor or speed of response to incidents. The Russian practice of crisis response to incidents of a subject-object nature is considered, in which the coefficient of preparedness for crisis situations is calculated as the ratio of the total time of the object's uninterrupted operation to the sum of the object's recovery time in case of a failure and a given period of uninterrupted operation in hours set in the economy in question. It is important to take into account that for the period of uninterrupted operation of the facility, a necessary condition is the interaction of 4 factors, which are considered as independent variables in the multiple regression model. The presented model has a sufficient degree of significance and stability for express diagnostics by the management

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of an organization of preparedness for crisis situations for various sectors of the world economy.

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JEL codes: G01, H12, C54, C63

1. Introduction

The world is faced with large-scale incidents that take the form of cyberattacks, accidents in technological systems, violations of the integrity of information channels. Threats of a natural, ecological and biological nature (floods, earthquakes, pollution of water bodies, epidemics, pandemic, etc.) are becoming more and more probable. As pointed out by Deloitte (Deloitte & Touche CIS, 2019; PricewaterhouseCoopers [PwC], 2020), the management of large companies with annual revenues of $500 million to $20 billion are experiencing difficulties in objective preparedness for crisis situations amid subjectively overestimated confidence in this readiness. According to a PwC study, there has been an increase in the number of organizations experiencing significant business disruptions - 47% in 2020 versus 40% in 2019 (PwC, 2020).

Various models of crisis development are known (Perles-Ribes et al., 2016; Kochetkova, 2012), in which the stages and factors of predictable and unpredictable crises are distinguished. At the same time, the share of predictable crises (70%) in the total number of potential crises indicates that it is possible to prepare for this kind of situations (Smith, 2012). The specificity of the activities of a number of industrial enterprises potentially forms the threat of technological accidents. This applies primarily to transport companies, oil and gas, coal companies as dangerous businesses.

It is imperative for a dangerous business to prepare in advance for negative events that can disrupt the smooth operation of the enterprise. It is also important for companies that are not directly related to the impact of man-made factors, but operating in conditions of turbulent markets, to be prepared for crises of a "known nature". At the same time, for them, the issue of response time to threats is one of the key issues in maintaining business continuity (PwC, 2020). The ability to recover, or partially stop business processes for a short time, even during the elimination of large-scale incidents, allows you to minimize losses from the incident. Therefore, the organization's ability to diagnose its preparedness for an incident or crisis situation requires appropriate reinforcement. The search for possible solutions to the problem of the organization's preparedness for a crisis led to the idea of formalizing the relationship between the response time to crises and the conditions for preparing for incidents. At the same time, the formalization of connections in this study is of a qualitative nature, which is scarcely represented in the existing models of diagnostics of preparedness for crisis situations.

Thus, the results of analytical studies conducted by well-known consulting companies (Deloitte & Touche CIS, 2019; PwC, 2020) in the course of studying aspects of companies' preparedness for crises, as well as the main provisions of the international standards "Business continuity management systems" (ISO 22301, 2019; ISO / PAS 22399: 2007), providing guidance on incident preparedness and business continuity, have identified a number of patterns relevant to the research topic. First of all, in the context

of express diagnostics, the non-financial parameters of the organization's activities will be considered, which are popular positions in the well-known guidelines for the prevention of incidents (Bentley et al., 2014; Smith, 2012).

2. Materials and Methods

Questions of the theoretical content of anti-crisis management, sustainability and business continuity continue to be relevant for the management of Russian companies of various levels and scales in conditions of instability of economic systems at various phases of economic cyclicality (Luzgina, 2018). The problems of crisis response acquired particular significance during the period of the well-known pandemic of the 21st century, when new models were required for the correspondence of the economic behavior of economic entities to the new objective requirements of lockdown (Orlova, 2020). However, modeling the economic behavior of subjects in a crisis becomes relevant even in the post-COVID period in order to use this understanding to influence optimal decision-making. That is why the practice of crisis response requires decisions of both subjective and objective nature. In particular, the measures for preparing for crisis situations and taking into account the indicators of the continuity of the critical process are insufficiently developed and leave the interest of many researchers.

The possibilities of using marketing tools in order to improve the efficiency of the financial performance of commercial organizations in the context of instability (Chupina, 2016), as well as a risk-based approach to crisis prevention (Weider, 2020), can be devised in the development of rules for implementing anti-crisis communications. A feature of the presented work is an attempt to supplement the basic provisions of the theory of anti-crisis management (Kochetkova, 2012) and the principles of response and recovery after incidents and crisis situations (Deloitte & Touche CIS, 2019) with a model for accounting for non-financial factors of a subject-object nature.

It is known that existing multivariate models for assessing the financial condition of a company can determine the signs of an organization's insolvency (Muller-Stewens & Lechner, 2016). This is the side of the analysis of the tangible assets of the organization. However, the formation of an organization's culture of Incident preparedness and operational continuity management (IPOCM) can be viewed as a type of intangible asset that contributes to the growth of management quality (Weider, 2020). The IPOCM implementation standard specifies the terms of the company's trust relationship with its counterparties, the subjects of the incident, if it occurs («Russian standard 53647.4-2011. Business Continuity Management». Introduced on December 1, 2012). Therefore, we believe that diagnostics of intangible assets is no less important, which may not always be reflected in the balance sheet, but affect the market value of the company. A cost-based approach to assessing a company's readiness for a crisis can be supported by a qualitative analysis of business sustainability factors (ISO / PAS 22399, 2007). So, in most of the known separation models at the stage of the crisis process, the stage of qualitative changes (conflicts) and the stage of quantitative changes (losses) are distinguished. Therefore, this article describes the mutual influence of quantitative and qualitative factors.

The purpose of the study is to search for an express model for diagnosing an organization's readiness for a crisis based on the correlation

dependence of the factors of uninterrupted functioning. In this context, quantitative dependencies determine the quality - the degree of preparedness for a crisis situation. The main research methods were: analysis of secondary data obtained in the course of a retrospective study (PwC, 2020), regression analysis of factors, synthesis of the estimates obtained to form a final conclusion. Note that regression analysis can be used in a variety of simulated situations, where some degree of involvement in the process predetermines the results (incidents) of the process under study. MS Excel package is used.

The hypothesis of this study is the assumption that there is a correlation between the degree of business continuity and the factors of preparedness for crisis situations and negative consequences for the company. The consequence of a possible dependence is the conclusion: the more significantly the degree of continuity is expressed, the more prepared the company is for the crisis, the faster decisions are made regarding the incident, the less various kinds of losses the company will incur. To achieve this goal, it is necessary to solve the following tasks:

1) definition of basic concepts, designations (crisis preparedness factor, Kcp);
2) selection of factors of the company's preparedness for a crisis in various sectors of the economy;
3) formation of an array of data on the numerical values of the readiness factors and the readiness factor for various businesses (on the example of international and Russian companies);
4) determination of the type of analytical relationship between factors and the availability factor using regression analysis;
5) drawing up a scale of the degree of business continuity in a crisis and the corresponding express diagnostics.

3. Results

Let us turn to the conclusions that were obtained earlier, and which were transformed to meet the objectives of the study. Below is a description of the solution of the corresponding tasks (numbering of items for each task: 3.1-3.5).

3.1. In accordance with the risk-based approach (Deloitte & Touche CIS, 2019), incident preparedness is understood by the author as a system of intra-organizational measures developed and implemented before an incident occurs, the purpose of which is to mitigate negative consequences and select the optimal tools for rapid recovery of the organization after incidents of a different nature. An incident is considered in this context as an unfavorable combination of circumstances, a negative event that directly affects an entity or organization. At the same time, a crisis situation is one or more incidents, as well as other emergency events that directly or indirectly affect a subject or organization. To build a model of the dependence of the degree of business continuity on the factors of ensuring preparedness for incidents and business continuity, it is necessary to select those that can be translated into measurable indicators.

It is known that the success of actions to resolve emerging incidents is achieved subject to compliance with the requirements and recommendations (principles) for business continuity (Bentley et al., 2014):

- leadership and management commitment;
- business continuity policies;
- responsiveness;

- information transparency;
- team approach;
- consistency and cyclicality of decisions;
- work with all groups of interested (involved) persons.

Adherence to the above principles is voluntary on the part of a particular company and can manifest itself in different ways in its business processes. In turn, the manifestation of these factors may indicate a different degree of preparedness of the company for a crisis situation. Further, we will accept the proviso that the principle of responsiveness in terms of speed is one of the essential ones, since it manifests the effectiveness and relationship with all other factors (the author's point of view). So, referring to the results of an analytical study (PwC, 2020), you can highlight the industries in which, to one degree or another, there were measures to respond to a crisis situation. The respondents were representatives of such industries as:

1) Finance;
2) IT-technologies;
3) Transport (freight);
4) Transport (passenger);
5) Telecommunications;
6) Education (basic);
7) Education (business);
8) Trade;
9) Oil and gas industry;
10) Construction;
11) Public authorities;
12) FMCG;
13) Other.

Let's introduce the basic concepts and designations. The time factor is the main factor in the proposed model. Let the coefficient of preparedness for crisis situations, Kcp, is the ratio of the time of uninterrupted operation of the object to the sum of the time of such work and the time of restoration of the object taken for the same calendar period. The coefficient characterizes the facility's ability to ensure its uninterrupted operation with the correct use of all possible conditions (factors) of crisis response. The subject of uninterrupted work is an organization (company), the object of uninterrupted work is an action, a process. Then the formula for calculating the coefficient of preparedness for crisis situations (Kcp) is as follows:

$$Kcp = T_1/(T_1+T_2), \quad (1)$$

where:

T1 - total time of the object's uninterrupted operation, h;

T2 - recovery time of the object in case of failure, h.

For the indicator T1, the condition for continuous operation is the interaction of the most significant factors of continuity selected during the study (March 2020 - August 2020). Since the working time for the year differs by industry, we will proceed from the average values for the industries of the Russian Federation. For simplicity of calculations, we will accept the following assumption: working hours for 2020 (in hours) with a 36-hour working week - 1,780,6 hours with an average monthly number of working hours – 148,4 hours, then the semi-annual standard time is 890,3 hours. We will proceed from this limitation in the period March 2020 - August 2020. The calculation of values will be presented below in Table 1.

3.2. Further, we note that the principle of speed of response, related to time (optimal decisions within the first 4 hours from the occurrence of incidents), manifests itself in the following factors of preparedness of organizations for an incident, as shown by 25% of respondents in a study (PwC, 2020):

1) crisis exercises: proactive development of the main measures and actions for crisis response (trainings, business games, educational simulations, etc.);
2) differentiated formats for testing the developed recovery plans (corporate responsibility policy for continuity, insurance etc.) and testing them;
3) the presence of a recovery team (crisis headquarters) with identified leadership;
4) special means of communication.

The above list is not final and complete, but reflects the subject-object nature of the factors for the desired model and the importance of restricting the choice. A significant conclusion based on the results of the above study is the equal ratio of critical processes with disruption of continuity, which led to their shutdown, and the lack of continuity of processes (50%). At the same time, most companies were unable to return to normal operation in a short time - the restoration of critical business processes / services took more than 4 hours, in fact, this process took several days (2-7 days).

It is also important to learn about the causes of disruption to business continuity among survey participants (PwC, 2020). The main reasons were: a failure in the information system, a power outage, a break in the communication channel. Most of the reasons are associated with the above groups of factors.

3.3 To solve the third problem, let us present a quantitative interpretation of these factors:

1) According to crisis exercises. Let's single out the indicators of the frequency of crisis exercises and testing plans (not once, once a year, more than 2 times a year). The frequency of measures for this factor during the year will be considered as a field of observation of the numerical values of the indicator. The maximum value of the indicator for this factor is 8 times a year.
2) According to the formats of testing recovery plans, many companies pay attention to, for example, such as: revision of the plan; simple testing (verification of knowledge of roles and functions without practical implementation of actions); testing the performance of individual objects, for example, information systems (most often); insurance contract for critical processes; simulation of an emergency situation, etc. You can count about 4-5 formats. According to a PwC study, only 8% of companies conduct all types of testing, 35% of companies are limited to one type of testing. Therefore, the number of different formats of test types will be considered as an observation field for the numerical values of the indicator. The maximum value of the indicator for this factor is taken equal to 8.
3) General requirements are known for the crisis response team (anti-crisis headquarters): the optimal composition of the team is the representation of employees of different blocks and levels of management in order to effectively implement the business continuity system. Employees of different departments can be involved in the team for ensuring referrals:

- Risk and top management;
- Physical security;
- Information security;
- Occupational health and safety;
- Civil Defense and Emergencies;
- Public Relations;
- Recovery Rescue Teams.

As the data of the analytical study used show, more than 50% of companies (survey participants) include more than 5 different departments in the team, and about 8% conduct exercises for one specific function. Note that the possibility of inviting external third-party observers to conduct tests and exercises is recorded (19% of companies surveyed by PwC). The size of the team will be considered as a field of observation for this indicator: 0-10.

4) With regard to the use of communication means, the following picture emerged: 50% of companies use tools for automating anti-crisis management processes, among which the most common are crisis communication automation systems: SMS notifications, e-mail mailing lists, hotline, stand, corporate radio, intranet chat) and incident monitoring and registration systems. The number of different means of communication will be taken as the field of values for the communication factor: 1-8.

Let us show that the values of the availability factor differ by industry (Table 1):

Note that in the context of the implementation of communication measures to ensure business continuity and anti-crisis management, this factor is a competitive advantage of companies not only in terms of increasing the smoothness of their activities and reducing possible losses, but also in terms of reputation and creating a positive information field.

For example, disclosure of information on implemented measures to ensure preparedness for a crisis increases the level of reliability of the organization in the eyes of customers and counterparties.

Table 1. Average values of working time and recovery time, calculated values of the preparedness factor for crisis situations (for the industries of the Russian Federation, March 2020 - August 2020).

Industry	Total time of the object's uninterrupted operation, T_1, h	Recovery time of the object in case of failure, T_2, h	Crisis preparedness factor, Kcp
1 Finance;	890	108	0,89
2 IT-technologies;	890	54	0,94
3 Transport (freight)	890	108	0,89
4 Transport (passenger)	890	480	0,65
5 Telecommunications	890	108	0,89
6 Education (basic)	890	120	0,88
7 Education (business)	890	96	0,90
8 Trade	890	216	0,80
9 Oil and gas industry	890	96	0,90
10 Construction	890	108	0,89
11 Public authorities	890	270	0,77
12 FMCG	890	840	0,51
13 Other	890	270	0,77

Source: Compiled by the author based on data analysis Production calendar of the Russian Federation, 2020

According to an analytical study (PwC, 2020), 55% of participants indicated that they publish information about ongoing testing and crisis drills. Most companies implement this through communication on the organization's website. During the study, in addition to analytical research data (PwC, 2020), information from the Production calendar & Ministry of Labor of the Russian Federation, 2020 was used on the number of workers hours on average by industry, meaningful actions for half a year - from March 2020 to September 2020.

We will form an array of data on the numerical values of the readiness factors and the readiness factor for various businesses (using the example of international and Russian companies). The data on the recovery time after a crisis situation are calculated according to the average values specified in the Production calendar of the Russian Federation, 2020. It is important to obtain the values of the availability factor as a function of time - formula (1).

As can be seen from Table 1, the highest value of Kcp = 0,94 was observed in the information technology industry, the lowest (0,51) - in the FMCG consumer goods trade. Obviously, the value of Kcp cannot exceed 1.

Next, we will form an array of numerical values for calculating the regression model. In the proposed model, the availability factor Kcp is endogenous (resulting), and all other factors are exogenous (given). Then the correspondence of the preparedness factors in terms of the impact on the recovery time to the calculated values of the preparedness factor for crisis situations is presented in Table 2.

3.4 Let us move on to solving the fourth problem. The construction of the required model for express diagnostics of preparedness

Table 2. Correspondence of preparedness factors for various industries to the calculated values of the preparedness factor for crisis situations.

Industry	Crisis preparedness factor, Kcp	Readiness factor X_1 - frequency of crisis drills per year	Readiness factor X_2 - number of different test formats	Readiness factor X_3 - the size of the crisis recovery headquarters	Readiness factor X_4 - the number of different means of communication
1 Finance;	0,89	3	4	5	4
2 IT-technologies;	0,94	2	4	4	3
3 Transport (freight)	0,89	1	2	3	2
4 Transport (passenger)	0,65	2	3	3	4
5 Telecommunications	0,89	2	4	6	6
6 Education (basic)	0,88	0	2	3	4
7 Education (business)	0,9	1	3	6	3
8 Trade	0,8	2	3	5	2
9 Oil and gas industry	0,9	3	5	9	5
10 Construction	0,89	2	2	8	3
11 Public authorities	0,77	2	2	3	2
12 FMCG	0,51	1	2	2	4
13 Other	0,77	1	2	3	4

Source: Compiled by the author based on analysis of research data (PwC, 2020)

for a crisis situation is reduced to finding the form of the multiple regression equation and evaluating its parameters (the choice of the type of model is predetermined by the author).

The MS Excel package was used as a search tool for the type of model. The problem of multicollinearity of factors is excluded. Then, the desired model takes the form of linear multiple regression:

$$y=0,72-0,08X_1+0,08X_2+0,03X_3-0,05X_4, \quad (2)$$

where:

y - the resulting factor is the coefficient of preparedness for crisis situations; independent readiness factors:

X_1 - frequency of crisis drills per year;

X_2 - number of different test formats;

X_3 - the size of the crisis recovery headquarters;

X_4 - the number of different means of communication.

The results of evaluating the model (2) for adequacy showed that the multiple regression coefficient R = 0.73, therefore, there is a close relationship between the availability factor and the investigated factors X1, X2, X3, X4; the coefficient of determination R^2 = 0.53, which means that 53% of the variation in the availability factor is explained by the variation of the factors under consideration; at the 5% significance level, it can be argued that the considered correlation is statistically significant, since the value of the F-criterion in the table is greater than its calculated value: Fcrit (3,06)> Fcalc (0,07).

3.5 Let's move on to describing the last problem. Thus, the multiple regression equation (2) is significant, therefore, the revealed relationship between the factors of the organization's readiness for crisis situations and the readiness factor can be used in the well-known interpretations of the direct pairwise relationship between the readiness factors and the readiness factor. The revealed dependence by factors readiness gives a more realistic result if we introduce a scale for the interpretation of Kcp values (Table 3).

Using data on the four factors of readiness (continuity) that were involved in Table 2, you can get an express result on the degree of continuity of the organization, which actually indicates the company's readiness for a crisis. Note that all four factors cannot take zero values at the same time. However, if all values are 1, then this is a low availability situation.

Let's check the model using the example of the sphere of passenger transport (railway). In equation (2), we substitute the averaged data on availability factors from Table 2 for these enterprises (position 4), respectively: 2; 3; 3; 4. We get the value Kcp = 0,69, which corresponds to the position in table 3 as a low degree of continuity. Indeed, in the context of a pandemic, it was passenger transport that

Table 3. The scale of the dependence of the degree of business continuity of the organization on the values of Kcp

Crisis preparedness factor values, Kcp	The degree of continuity of the organization
0-0,5	very low
0,59-0,79	low
0,8-0,9	medium
0,91- 1,00	high

Source: Compiled by the author.

experienced the greatest negative influence of the factor on the use of various means of communication with client markets.

4. Discussion

The proposed model has a number of limitations:

- the number of factors involved may be different. In the course of the analytical study, at least four factors were identified, however, the factors selected for the model were determined during the check for the absence of mutual influence;
- to obtain data on factors, it is enough to contact the management of the organization, since this information should be in the field management competence;
- the R^2 indicator indicates the average quality level of the resulting model. But the principle of dependence on readiness factors gives a realistic result;
- existing approaches to crisis diagnostics of business are more often based on cost estimates, which does not always adequately reflect the situation; no analogues to the qualitative approach proposed in this paper have been previously identified;
- the model assumes binding to the time factor, therefore, an indication of the calculation period is given;
- the model can be considered universal, acting for diagnostics of preparedness for a crisis situation in relation to any business, including to determine the preparedness for incidents for organizations of the non-profit sphere.

However, the very process of an organization's preparedness for a crisis, according to experts from the Russian Presidential Academy (Asmolov, 2020), can exhaust the strength and potential of business. It is obvious that the search for reserves for work in emergency situations requires additional efforts, but savings in this case can lead to even more sad consequences. For example, some countries turned out to be an example of unpreparedness for a pandemic, while ecosystems with an excess of values turned out to be ready. But in the context of the proposed model, we are not talking about country ecosystems, but about systems at the scale of an organization-corporation, which does not detract from the value of the model.

5. Conclusion

Thus, it is shown that the crisis preparedness coefficient can be determined through the obvious preparedness factors: the frequency of crisis drills, the number of different formats for testing developed recovery plans, the presence of a recovery team (crisis headquarters) with identified leadership, the presence of various kinds of special means of communication, which were described above. The greater the value of the coefficient Kcp, the higher the degree of continuity of the organization. The proposed express model of crisis preparedness diagnostics allows at the stage of strategic changes to assess the state of business continuity with the involvement of various factors of non-financial nature for organizations in various sectors of the world economy.

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