Scientific Journal of Astana IT University
ISSN (P): 2707-9031
ISSN (E): 2707-904X

DOI: 10.37943/AITU.2020.94.59.003
UDC: 005:08

D. Lukianov
Candidate of Technical Sciences, Department of construction and operation of buildings and structures
lukianov@live.com, orcid.org/0000-0001-8305-2217
Belarusian National Technical University, Belarus

K. Kolesnikova
Doctor of Technical Sciences, Professor, Department of the Technology Management
amberk4@gmail.com, orcid.org/0000-0002-9160-5982
Taras Shevchenko National University of Kyiv, Ukraine

O. Mezentseva
Candidate of Economic Sciences, PhD in Economics and enterprise management, Assistant of the Department of technology management
olga.mezentseva.fit@gmail.com, orcid.org/0000-0002-8430-4022
Taras Shevchenko National University of Kyiv, Ukraine

V. Rudenko
Master student of Computer science
vladislava.rdnk@gmail.com, orcid.org/0000-0002-4005-4957
Taras Shevchenko National University of Kyiv, Ukraine

THE KUBLER-ROSS FACTOR IN MANAGING THE PERFORMANCE OF TECHNICAL AND SOCIO-ECONOMIC SYSTEMS

Abstract: The article proposes to consider the possibility of using the Kübler-Ross model as a mandatory and necessary addition when restoring systems after critical failures, accidents, and other catastrophic events. As stages of the model, it is proposed to consider the "extension" of the classical Kübler-Ross model in the form of an Extended Grief Cycle. Moreover, each "stage of the model" is considered as a separate "state" of the system. It is also assumed that the transition from any state of the model is possible not only "linearly forward", but also in any other direction. Moreover, the probabilities of such transitions do not depend on the previous history of the system. Such an assumption allows us to consider the possibility of interpreting the created model as a Markov model, and, accordingly, to apply the mathematical apparatus of Markov chains for its study. It is proposed to consider such a characteristic of an effective recovery system as the "readiness" of a recovery team to transition to a productive state as soon as possible from the point of view of group dynamics and the effectiveness of the distribution of team roles. For this, it is proposed to use the logic of the team role model of R. Belbin. Minimizing the time to achieve the effect of maximum effectiveness in emergency situations in the context of the concept of incident preparedness and continuity of work, in this case, will depend not only on technical and other means of response but also on the psychological stability of the recovery team members, the effective allocation of roles and readiness for adequate action. This is confirmed by the results of transient modeling. The simulation results show the dominant value of the probabilities of being in the states of "shock" and "inoperative system" if you do not control the system purposefully and do not go through all stages of the Extended Grief Cycle model sequentially, one after another.

Key words: The Extended Grief Cycle, Kübler-Ross model, Model R. Belbin roles, Markov model of communications, performance recovery, business continuity, reliability, hazardous event, Business Continuity Management Lifecycle Stages, preparedness for hazardous situations and incidents

Introduction

Since the beginning of the 21st century, in the field of organization management, more and more attention has been paid to the issues of restoring the working capacity of technical, economic and social systems after accidents, disasters, and other failures of various nature. Many countries have established their own national standards – Israel (SI 24001: 2007 Security and continuity management systems – Requirements and guidance for use of the Standards Institution of Israel (SII), Japan (JIS Q 9005:2005 Quality management systems – Guidelines for sustainable growth) , Australia (HB 221:2004 Business Continuity Management), UK (BS 25999 Business continuity management). There are also examples of industry-wide application of such management approaches – the international non-profit organization for ensuring fire, electrical and building safety was developed the standard NFPA 1600: 2007 Standard on Disaster / Emergency Management and Business Continuity Programs The British standard aimed at ensuring business continuity BS 25999 [1, 2] received its further, international development. Based on ISO, a series of Business continuity management systems standards were developed: from Requirements [3] to Guidance directly [4], many of its provisions can be seen in other standards, in particular in the field of information technology [5]. Also included in the professional glossary is the concept of "preparedness" in the context of IPOCM – Incident preparedness and operational (business) continuity management – in particular, preparedness for incidents and business continuity, in particular, ISO/PAS 22399:2007 Societal security – Guideline for incident was developed preparedness and operational continuity management [6]. Moreover, this approach has been increasingly applied in other areas of activity. At the same time, of course, both customers and project executives still continue to worry about the attainability of the expected results both in time and in terms of the costs that must be incurred to create the product and put it into operation, including and possible risks associated with the further operation of the created product (service), the implementation of which may lead to a time interval during which the possibility of obtaining value from ownership of the product (service) is impossible or limited. From the point of view of the standard ISO / PAS 22399: 2007 for incident preparedness and operational continuity management [7]), this is demonstrated as follows:

At the same time, if an analysis of the processes of a constantly operating organization is carried out, it is necessary to distinguish part of its activity processes as critical activities (critical activities): The types of organization activities that must be performed to ensure the delivery of key products and services that allow achieving the most important goals of the organization. In the context of the implementation of projects, in some cases, this can be both part of the work operations, for example, lying on the critical path of the project, and, in some cases, such "critical activities" can be almost all project operations, as constituent sets " necessary and sufficient "project work.

As can be seen from Fig. 1, the main idea is to reduce, on the one hand, losses, which, at first glance, is achieved primarily by actions aimed at reducing the duration of the service unavailability period (or by its inability to meet certain minimally sufficient performance criteria).

It is also logical to decompose what is happening from the moment of the "incident" to the full restoration of the service. An example is the more detailed model presented in Fig. 2, in which the following periods are considered (for which ways to manage them are also proposed).

Scientific Journal of Astana IT University
ISSN (P): 2707-9031
ISSN (E): 2707-904X

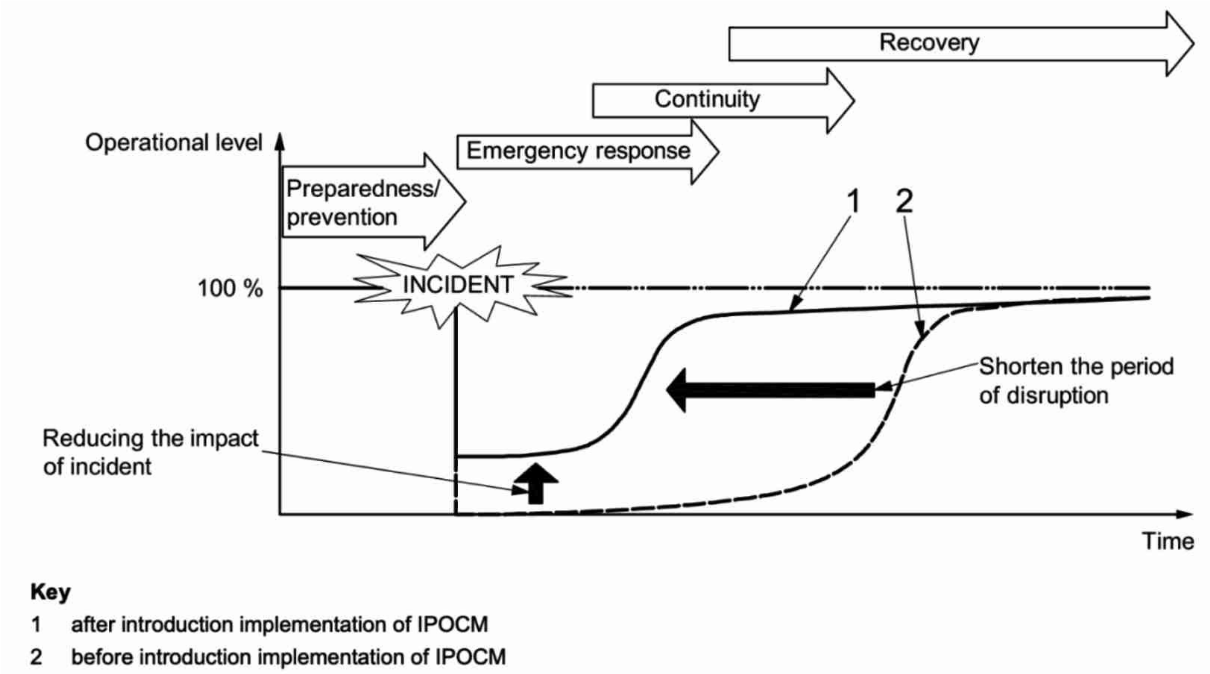

Fig. 1. Concept of incident preparedness and IPOCM (based on [7])

The Recovery Point Objective (RPO) determines the maximum acceptable amount of data loss measured in time.

The Recovery Time Objective (RTO) determines the maximum tolerable amount of time needed to bring all critical systems back online.

The Work Recovery Time (WRT) determines the maximum tolerable amount of time that is needed to verify the system and/or data integrity.

The sum of RTO and WRT is defined as the Maximum Tolerable Downtime (MTD) or Maximum Tolerable Period of Downtime (MTPOD) which defines the total amount of time that a business process can be disrupted without causing any unacceptable consequences. Moreover, as can be seen in Fig. 2.

$$(RS) = (RPO) + (MTD) \tag{1}$$

If we consider the “full cycle” in the above example, it makes sense to consider such a set of events on the timeline: Last Consistent Backup (LCB); Unexpected Event (UE); Damage Assessment (DAA); Disaster Assessment (DIA); Disaster Declaration (DID); Resume Services (RS), which, in turn, should be supplemented with an event such as Next Consistent Backup (NCB), which, if successful, will become Last Consistent Backup (LCB) for the next work cycle.

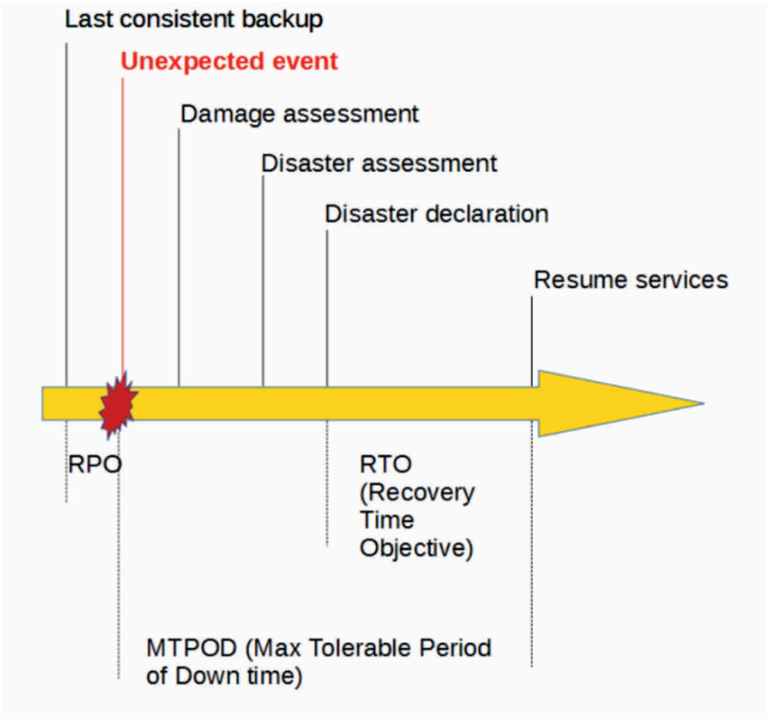

Fig. 2. Incident preparedness concept (based on [8])

It is also important to understand the difference in Recovery Point Objective (RPO) and Recovery Time Objective (RTO), are two of the most critical parameters of a data protection plan and disaster recovery strategy. These measurements are related and necessary to application and data availability. Despite their similarities, RPO and RTO serve different purposes and come with different metrics. Recovery Point Objective = Data Risk. RPO refers to the maximum acceptable amount of data loss an application can undergo before causing measurable harm to the business.

Recovery Time Objective = Downtime. RTO states how much downtime an application experiences before there is a measurable business loss. [9]

Moreover, as shown in a study [10], the presence of LCB is absolute assurance system recovery after a failure / accident critical (Fig.3).

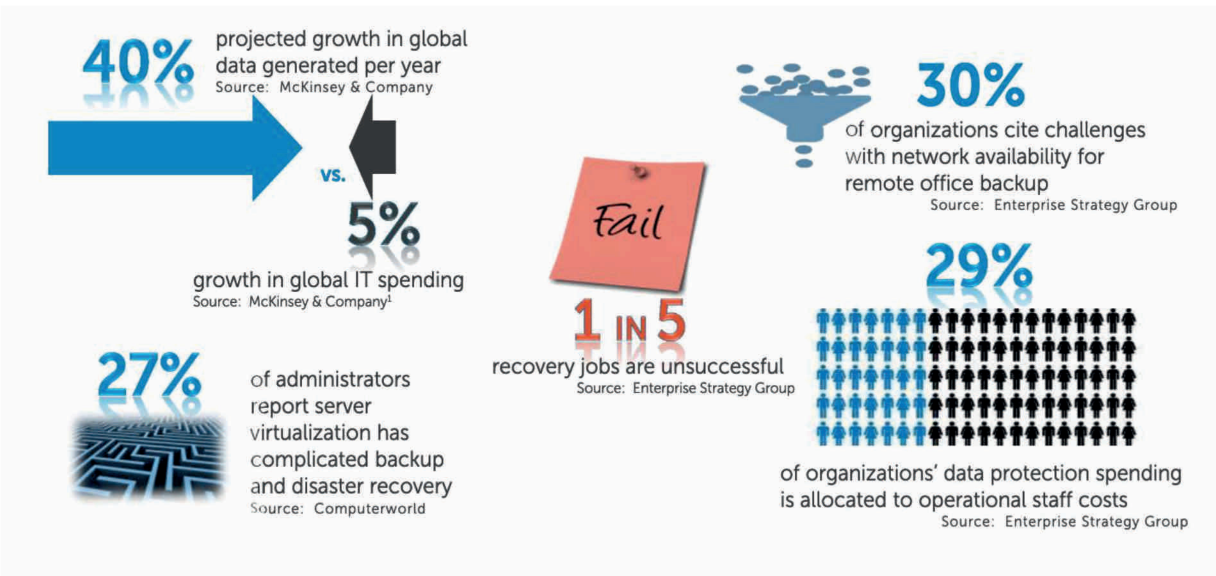

Fig. 3. Incident preparedness concept (based on [10])

Scientific Journal of Astana IT University
ISSN (P): 2707-9031
ISSN (E): 2707-904X

The following sources of business continuity threats are distinguished, for which a different ratio between RPO and RTO can be predicted:

Crisis: Incident (s) and incidents caused by the human factor and / or the effects of natural phenomena and the environment, requiring urgent intervention and action to protect human life, property or the environment.

Disaster: An event causing great damage or loss.

Violation (destruction of the organization) (disruption): The inability to deliver products or the provision of services established in accordance with the goals of the organization, or interruptions in this activity caused by an expected (e.g., strike of workers) or unforeseen (e.g., blackout of electric energy) incident. Note – Violation / destruction can be caused by positive and negative factors that disrupt the normal course of activity.

Emergency: A sudden, emergency, usually unexpected incident or event requiring urgent action (A major accident, usually with human casualties, is a disaster) [11]

The model shown in Fig. 4 is somewhat mathematically idealized, but the general principle is sufficiently illustrated.

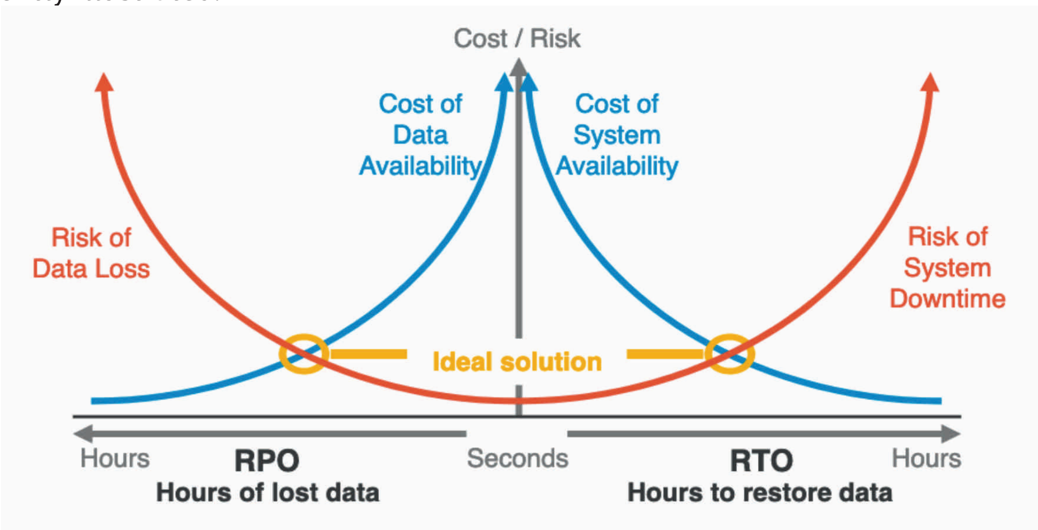

Fig. 4. The concept of an “ideal solution” to restore performance (based on [10])

The task, at first glance, is quite simple – you just need to find the optimal (acceptable) RPO / RTO ratio. But, as practice shows, there may be situations where the cost of data recovery from the moment of LCB is not only high, but such an attempt leads to a significant RTO, while also increasing the total service unavailability time, exceeding MTD. There are cases when an informed decision was made about data loss and system rollback to a previous state without attempting to restore data (at least within one “cycle”). Conversely, in some cases, the cost of data loss can be quite significant, which leads to the need to design systems of “high reliability” in which multi-stage duplication of elements can be provided with minimizing the time it takes to switch to a backup system (not necessarily in the field of data loss – for example, it may be a power backup system in the energy sector). Of course, in connection with this, it is necessary to adopt the expected model of the “ideal solution” for the system under consideration with its unique RPO / RTO ratio for a particular system. This, in turn, was also reflected in the standards and the corresponding glossary for the main “entities” under consideration: incident preparedness: actions, programs and systems developed and implemented prior to the occurrence of an incident that can help the organization mitigate the consequences and choose an effective response in the event of an incident, as well as accelerate the organization’s recovery from damage, disaster, critical situations or accidents incident preparedness and operational continuity management, IPOCM: Systematic and coordinated actions by which the organization rationally manages its risks and activities in the face of possible threats and dangerous impacts.

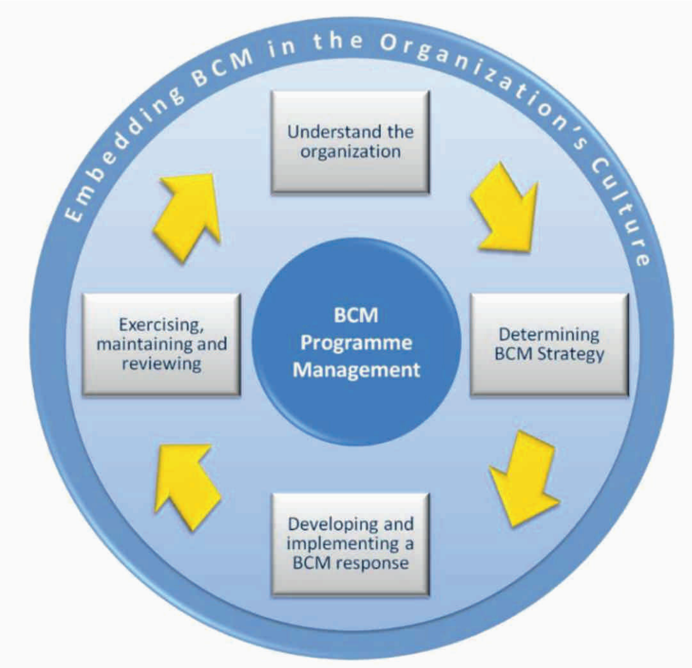

Fig. 5. Business Continuity Management Lifecycle Stages (based on [12])

Correspondingly, an "IPOCM policy" should be developed: General intentions and directions of the organization's activities in the field of incident preparedness and business continuity, formally formulated by senior management [12].

Problem

Nevertheless, in addition to technical factors and mathematically impartial scenarios, when considering scenarios for restoring the performance of complex systems, it is worth considering the human factor. In particular, the cycle considered in Fig. 2 may go unnoticed, i.e. everything that is noted between the LCB and the NCB proposed by us can be detected only at the moment when, for example, when you try to create an NCB, you will receive a notification about a system error / impossibility to create. This can be revealed even after several such cycles, which complicates finding the point of the last really working configuration of the system. This may be due to the fact that it is far from always possible to truly recognize an Unexpected Event (UE); Damage Assessment (DAA); Disaster Assessment (DIA); Disaster Declaration (DID) when a person makes a decision.

In any case, a significant deviation of the work scenario ("accident") from the expected (predicted) and the realization that this happened takes time. Even if this is written as a script in the executing system, it will still take some time to process such data. But in the case of consideration as a human executing system, it is worth using models that describe a person's behavior in a stressful situation. In fact, the neglect of the human factor is a problem that can negate any technical systems in the event of an untimely (or absent) decision to recognize the emergency situation.

Review of solutions

Some attempts to link staff behavior in a situation of stress with business continuity have already been made, but they are more likely to be of a nature aimed at solving local problems [13]. You need to minimize time between events such as Unexpected Event (UE) and

Scientific Journal of Astana IT University
ISSN (P): 2707-9031
ISSN (E): 2707-904X

Damage Assessment (DAA). Even if the technical monitoring system detects an Unexpected Event (UE), this does not necessarily mean that a person will be able to adequately perform Damage Assessment (DAA), especially in case of variability of the possible consequences of an Unexpected Event (UE). Nevertheless, similar patterns of behavior have been studied and are applied – primarily in the field of medical activity. The most famous of these models is the Kübler-Ross model [14], which, from our point of view, can be applied to each of the points where a person (operator) needs to make a decision to minimize the transit time of the Unexpected Event (UE) states; Damage Assessment (DAA); Disaster Assessment (DIA); Disaster Declaration (DID).

To date, it makes sense to consider the so-called "Extended" model, sometimes called "The Extended Grief Cycle" [15]. The Extended Grief Cycle can be shown as in the chart below, indicating the roller-coaster ride of activity and passivity as the person wriggles and turns in their desperate efforts to avoid the change.

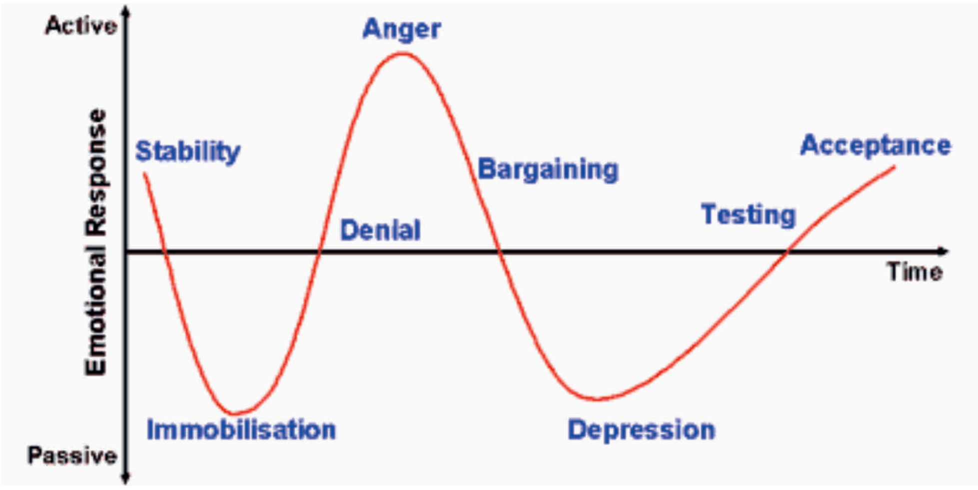

Fig. 6. The Extended Grief Cycle (based on [15])

The initial state before the cycle is received is stable, at least in terms of the subsequent reaction on hearing the bad news. Compared with the ups and downs to come, even if there is some variation, this is indeed a stable state.

And then, into the calm of this relative paradise, a bombshell burst:

- Shock stage*: Initial paralysis at hearing the bad news.
- Denial stage: Trying to avoid the inevitable.
- Anger stage: Frustrated outpouring of bottled-up emotion.
- Bargaining stage: Seeking in vain for a way out.
- Depression stage: Final realization of the inevitable.
- Testing stage*: Seeking realistic solutions.
- Acceptance stage: Finally finding the way forward.

* This model is extended slightly from the original Kubler-Ross model, which does not explicitly include the Shock and Testing stages. These stages however are often useful to understand and facilitating change [15].

Methodology

As the main tools for studying the life cycle of the liquidation of an accident (crisis) during operational activities to support the operability of a complex system (project), the efficiency (and speed) of emergency (project) teams, this set will be considered:

a) An extended model based on Fig. 2 [4]

b) Extended Kübler-Ross model [15]
c) Model R. Belbin roles in an effective team [16]
d) A model for the interaction of the project team with the project environment [17]
e) Organization of interaction between the emergency team members (project management team) based on and the logic of the possible transfer of the command role to the automated system [18,19].

Description of the results

It is proposed, based on the Markov model of communications constructed by the authors, to consider the following transition process diagram between the "sub-roles" of the project participants in the logic of R. Belbin's model (Figure 7) [17].

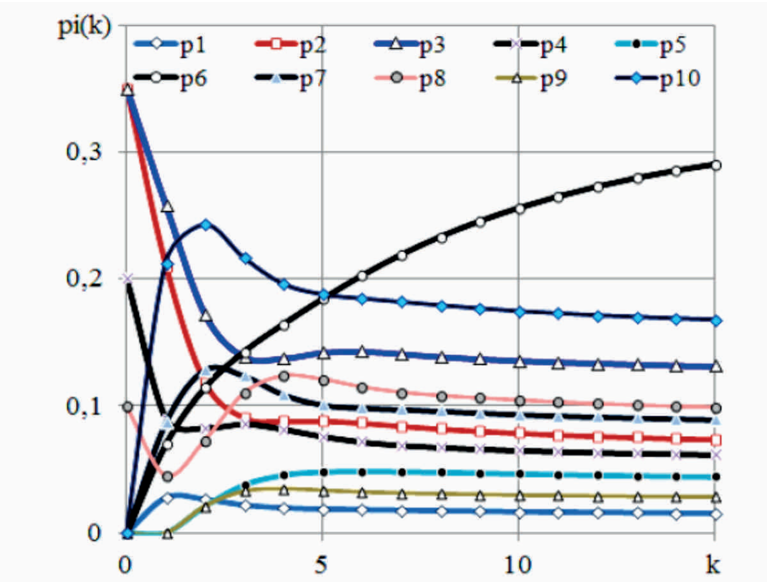

Fig. 7. Transients in the communication system of the project team (based on [17])

As can be seen in the transient diagram, at least five "steps" are needed in the constructed discrete model based on the transition probability matrix for an optimized role interaction process, so as to ensure the most efficient project implementation (p10). The diagram of transients between the following components of role-based communications presented in the project team after stabilization (five modeling steps) shows the following distribution: p1 – organizer, p2 – idea generator, p3 – coordinator, p4 – communicator, p5 – motivator, p6 – specialist, p7 – executor, p8 – controller, p9 – analyst, p10 – in fact, the project with all its properties and changing requirements. In the diagram, in descending order, after 5 steps (each of the "steps" in this case can be interpreted as a "sprint", similar to the logic of the model given in [9]), the following hierarchy of project communications is built: p6 – specialist> p10 – project > p3 – coordinator> p8 – controller> p7 – executor> p2 – generator of ideas> p4 – communicator> p5 – motivator> p9 – analyst> p1 – organizer.

Consider the extended Kübler-Ross model (Fig. 6). The model can be represented in the form of an oriented graph containing the states of the system (vertices of the graph) and transitions between them (edges of the graph). We assume that the system can pass from each state not only sequentially (as presented in the original model), but also jumps, skipping some states. For example, an instant transition to the "Productivity" state, which is the desired result of going through all the stages in the Kübler-Ross logic. Or the transition to the state of "Loss of productivity", which is the result of a long stay in each of the stages. For the extended Kübler-Ross model, an incident matrix was compiled (Fig. 8).

Scientific Journal of Astana IT University
ISSN (P): 2707-9031
ISSN (E): 2707-904X

Factor name	To	M1 -Shoch state	M2 - Denial state	M3 - Anger state	M4 - Bargaining state	M5 - Depression State	M6 -Testing state	M7 - Acceptance state	M8 - Repair/Normal state	M9 - Destroy/Poor state
From	I	1	2	3	4	5	6	7	8	9
M_1 -Shoch state	1	0	1	0	0	0	0	0	1	1
M_2 - Denial state	2	0	0	1	0	0	0	0	0	1
M_3 - Anger state	3	0	0	0	1	0	0	0	0	1
M_4 - Bargaining state	4	0	0	0	0	1	0	0	0	1
M_5 - Depression State	5	0	0	0	0	0	1	0	0	1
M_6 -Testing state	6	1	0	0	0	0	0	1	1	1
M_7 - Acceptance state	7	0	0	0	0	0	0	0	1	1
M_8 - Repair/Normal state	8	1	0	0	0	0	1	0	0	0
M_9 - Destroy/Poor state	9	1	0	0	0	0	0	1	0	0

Fig. 8. Incident matrix for the 9-state model of the extended Kübler-Ross model

For the obtained incidence matrix, the corresponding adjacency matrix of such an order was calculated that the matrix would not contain elements whose values are zero. In this case, the 7th order adjacency matrix will satisfy this condition. This means that the considered set of states forms a system of interconnected elements that affect each other in no more than 7 other elements (Fig. 9).

Factor name	To	M1 -Shoch state	M2 - Denial state	M3 - Anger state	M4 - Bargaining state	M5 - Depression State	M6 -Testing state	M7 - Acceptance state	M8 - Repair/Normal state	M9 - Destroy/Poor state
From	7	1	2	3	4	5	6	7	8	9
M1 -Shoch state	1	93	46	15	9	2	33	62	92	120
M2 - Denial state	2	54	26	9	5	1	19	36	52	68
M3 - Anger state	3	56	29	9	6	1	19	38	58	75
M4 - Bargaining state	4	69	31	12	6	2	25	45	62	83
M5 - Depression State	5	87	44	14	9	2	30	59	88	115
M6 -Testing state	6	150	62	27	11	5	56	96	125	170
M7 - Acceptance state	7	67	37	10	8	1	22	47	74	95
M8 - Repair/Normal state	8	108	42	20	7	4	41	68	85	117
M9 - Destroy/Poor state	9	83	25	17	3	4	34	49	51	75

Fig. 9. Seventh degree adjacency matrix for the 9-state model of the extended Kübler-Ross model

As it can be seen from the resulting model, the state "Testing stage" has the greatest impact on the system. The condition was introduced by the authors of the extended model of The Kübler-Ross Grief Cycle [15] and corresponds to the provision of Seeking realistic solutions. To implement this state, the following roles must be used in the recovery team: p6 – specialist, p2 – generator of ideas and p9 – analyst. Roles are listed in decreasing order of importance (Fig. 7).

Fig. 10 shows the transition probabilities for the original extended Kübler-Ross model. The probability values correspond to the Bayes-Laplace criterion.

Factor name	To	M1 -Shoch state	M2 - Denial state	M3 - Anger state	M4 - Bargaining state	M5 - Depression State	M6 -Testing state	M7 - Acceptance state	M8 - Repair/Normal state	M9 - Destroy/Poor state	Sum
From		1	2	3	4	5	6	7	8	9	
M1 -Shoch state	1	0,00	0,33	0,00	0,00	0,00	0,00	0,00	0,33	0,33	1,00
M2 - Denial state	2	0,00	0,00	0,50	0,00	0,00	0,00	0,00	0,00	0,50	1,00
M3 - Anger state	3	0,00	0,00	0,00	0,50	0,00	0,00	0,00	0,00	0,50	1,00
M4 - Bargaining state	4	0,00	0,00	0,00	0,00	0,50	0,00	0,00	0,00	0,50	1,00
M5 - Depression State	5	0,00	0,00	0,00	0,00	0,00	0,50	0,00	0,00	0,50	1,00
M6 -Testing state	6	0,25	0,00	0,00	0,00	0,00	0,00	0,25	0,25	0,25	1,00
M7 - Acceptance state	7	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,50	0,50	1,00
M8 - Repair/Normal state	8	0,50	0,00	0,00	0,00	0,00	0,50	0,00	0,00	0,00	1,00
M9 - Destroy/Poor state	9	0,50	0,00	0,00	0,00	0,00	0,00	0,50	0,00	0,00	1,00

Fig. 10. Transition probability matrix for 9 states of the advanced Kübler-Ross Model

The Bayes-Laplace criterion is a decision-making criterion in the absence of any information about the relative probabilities of "nature" strategies. In accordance with this criterion, it is proposed to assign equal probability values to all the strategies under consideration, in the absence of real data to obtain these values. After analyzing the system, adopt the strategy whose expected payoff will be the greatest. In this case, we will not take into account the fact that the range of evaluated alternatives for the same problem can differ significantly [21].

The simulation results are presented in Fig. 11. The initial state for the system was the Normal state, corresponding to the Stability stage in The Extended Grief Cycle model.

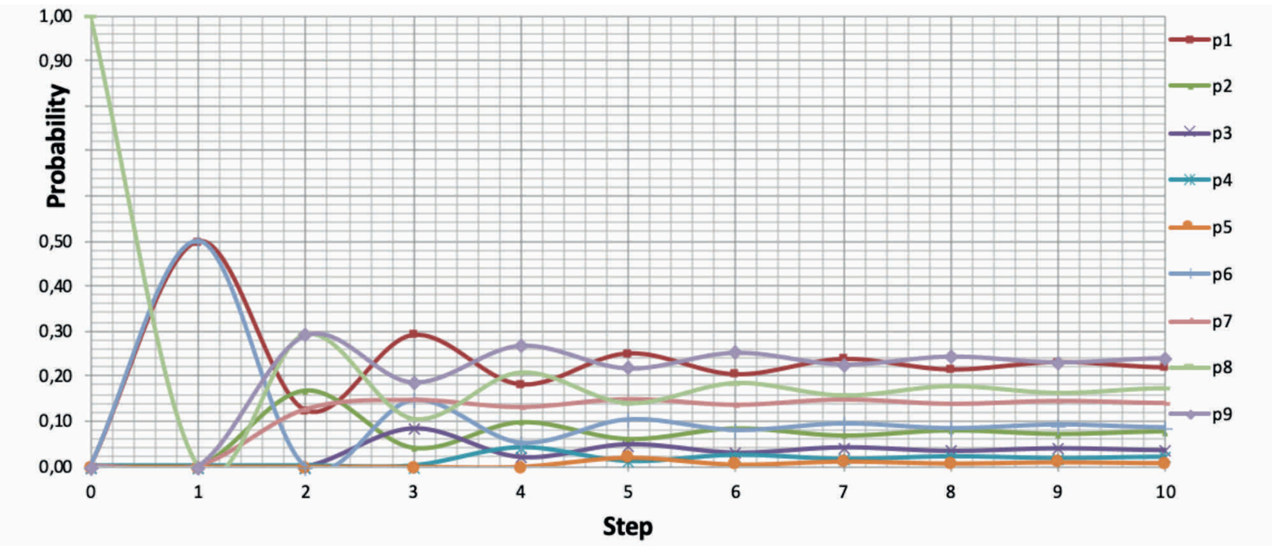

Fig. 11. Transient diagram for the 9-state model of the extended Kübler-Ross model

As can be seen from the obtained results, if it taken the values of transition probabilities equal for each of the possible transitions between the states of the system, then the states p1 and p9 will be the most probable – permanent change of states "Shock state" and "Destroy".

Scientific Journal of Astana IT University
ISSN (P): 2707-9031
ISSN (E): 2707-904X

Discussion

In it is proposed, on the basis of the Markov model of project advantages constructed by the authors, to consider the benefits received by the organization in a somewhat idealized situation. Given the need for business-critical applications to ensure the continuity of their operation, it is necessary to supplement such a model with a possible element of "loss of performance", and, accordingly, restore, but based on the proposals made in the article on expanding the model (Fig. 2) with such an element as NCB, and also taking into account the possible influence on the decision-making speed of factors taken into account in the Kübler-Ross model [22].

On the other hand, a possible way out of the pessimistic state (Fig. 11) would be to increase the time or work resource for the "Testing stage" state. To implement such a strategy, it is necessary that the recovery team must have people capable of generating, analyzing, and implementing creative innovative ideas for overcoming the crisis.

It should be noted that the results obtained by the authors indicate the need for further study of the structure of possible transitions between the states of the extended Kübler-Ross model transformed into the Markov model. It is also necessary to study more deeply the factors that can increase the likelihood of a system returning to its normal state. According to the authors, the solution lies in the ability of the recovery team to make and implement non-standard solutions.

Conclusion

Of course, further research in this direction will be of scientific and practical interest, on the other hand, the data and conclusions obtained even in this way allow us to make a general conclusion that it is necessary to take into account the logic and pace of transformation of the "participants" of the project into a "team" a project, for which it makes sense, at a minimum, to create conditions for the team to undergo, as soon as possible, processes related to training an adequate response to possible incidents, where the main task will be primarily to create a "human-automated system" team. And here you need to understand all the responsibility that may be on that particular person who will have to, in the appropriate situation, make the right decision. And take it as quickly as possible. As Nassib Taleb noted, "Military power means nothing; the decision is made by the cocker" [23]. On the other hand, only people can "cock the trigger" in complex technical and socio-economic systems, and "pull" (or refuse to do this for one reason or another) – completely different.

References

1. BS 25999-1:2006, Business continuity management - PART 1: CODE OF PRACTICE https://infostore.saiglobal.com/en-us/Standards/BS-25999-1-2006-2006-225498_SAIG_BSI_BSI_529292/ BS25999 B. S. 1: 2006: Business Continuity Management-Part 1: Code of practice //British Standard Institute (BSI) Std. – 2006.
2. BS 25999-2:2007, Business continuity management – PART 2: SPECIFICATION https://infostore.saiglobal.com/en-gb/Standards/BS-25999-2-2007-2007-280781_SAIG_BSI_BSI_648384/ BSI B. S. 25999-2: 2007 Business continuity management //Specification. BSI. – 2007.
3. ISO 22301:2012 Societal security – Business continuity management systems – Requirements https://www.iso.org/standard/50038.html ISO B. S. 22301: 2012. Societal security. Business continuity management systems. Requirements //British Standards Institute, London. – 2012. – C. 15-19.
4. ISO 22313:2012 Societal security – Business continuity management systems – Guidance, https://www.iso.org/standard/50050.html DIS I. S. O. 22313: 2012: Societal security–Business continuity management systems – Guidance //International Organization for Standardization. 2012.

5. ISO/IEC 27031:2011 Information technology – Security techniques – Guidelines for information and communication technology readiness for business continuity https://www.iso.org/standard/44374.html Techniques I. T. S. Iso/iec 27037: 2012 information technology security techniques guidelines for identification collection acquisition and preservation of digital evidence //ISO/IEC-The standard was published in October. – 2012.
6. Societal security – Guideline for incident preparedness and operational continuity management. (2008). https://www.iso.org/standard/50295.html Tangen S. ISO/PAS 22399 provides international best practice for preparedness and conti-nuity management //ISO Management Systems, 5.
7. Societal security – Guideline for incident preparedness and operational continuity management ISO/PAS 22399:2007 https://www.sis.se/api/document/preview/909330/
8. Business Continuity Concepts a Glance. (2014). https://ismetyaksi.wordpress.com/2014/04/15/business-continuity-concepts-at-a-glance/. Access date: 10.11.2019.
9. Trenton Baker What is RTO / RPO Redefined: The Race to Zero. ()https://www.keepitsafe.com/blog/post/the-difference-between-rto-and-rpo/.
10. Mathias Engstrand Data availability and protection. https://www.eiseverywhere.com/file_uploads/4b438e21c6d030eb97312aa52c3884c2_DataAvailabilityandProtection.pdf .
11. Information technology – Security techniques – Guidelines for information and communications technology disaster recovery services. (2008). https://www.iso.org/standard/41532.html. ISO/IEC TR 24762:2008
12. Robert Whitcher. A framework for resilience and success BS 25999-1:2006 Business continuity management. Part 1: Code of practice (2006). http://www.efectus.cl/upload_files/documentos/27102009085025-141381139.pdf
13. MENEDZhMENT NEPRERYVNOSTI BIZNESA Upravleniye chelovecheskimi resursami. (2013). GOST R 53647.8.
14. Pyat stadiy modeli Kyubler-Ross. https://orgdev.ru/pyat-stadiy-modeli-kyubler-ross-a23512a83e4a. Access date:10.11.2019.
15. The Kubler-Ross Grief Cycle. http://changingminds.org/disciplines/change_management/kubler_ross/kubler_ross.html Access date:10.11.2019.
16. Belbin, R.M. (2012). Team roles at work. Routledge.
17. Kolesnikov, O. (2016). et al. Development of the model of interaction among the project. team of project and project environment in project system. Vostochno-Evropeyskiy zhurnal peredovykh tekhnologiy. 5 (9). 20-26.
18. Lukianov, D. (2017). Development of the markov model of a project as a system of role communications in a team. Vostochno-Evropeyskiy zhurnal peredovykh tekhnologiy, 3 (3), 21-28.
19. Lukianov, D.V., Gogunskiy, V.D., & Kolesnikova, E.V. (2018). Transformatsiya komandnykh roley v upravlencheskikh komandakh. D.V. Lukianov. V.D. Gogunskiy. E.V. Kolesnikova / Materialy konferentsii VI Ukraïnsko-nimetska konferentsiya «Informatika. Kultura. Tekhnika», 1(1), 68-69.
20. Lukianov, D., Mazhei, K., & Gogunskii, V. (2019). Transformation of the International Project Management Association Project Managers Individual Competencies Model. 2019 IEEE International Conference on Advanced Trends in Information Theory (ATIT). Kyiv. Ukraine, 506-512. http://doi: 10.1109/ATIT49449.2019.9030486.
21. Delo, M., & Lopatnikov, L.I. (2003). Ekonomiko-matematicheskiy slovar: Slovar sovremennoy ekonomicheskoy nauki.
22. Piterska, V. (2018). Development of the Markovian model for the life cycle of a project's benefits // Vostochno-Evropeyskiy zhurnal peredovykh tekhnologiy, 5(4), 30-39.
23. Talebm, N. (2018). Kak vladet lyudmi v sovremennom mire. https://econet.ru/articles/163410-nassim-taleb-kak-vladet-lyudmi-v-sovremennom-mire – Access date: 09.01.2020.