



# Business Processes Modelling of the Karaganda Crisis Center Activity

Olga Shikulskaya<sup>1</sup>, Timur Esmagambetov<sup>2</sup>

<sup>1</sup>Department of Research Activities, Astrakhan State University of Civil Engineering, Astrakhan, Russian Federation

<sup>2</sup>Department of Information Technologies, Astrakhan State University, Astrakhan, Russian Federation

## Email address:

shikul@mail.ru (O. Shikulskaya), timur198300@mail.ru (T. Esmagambetov)

## To cite this article:

Olga Shikulskaya, Timur Esmagambetov. Business Processes Modelling of the Karaganda Crisis Center Activity. *American Journal of Operations Management and Information Systems*. Vol. 2, No. 1, 2017, pp. 15-20. doi: 10.11648/j.ajomis.20170201.13

**Received:** October 31, 2016; **Accepted:** November 24, 2016; **Published:** January 5, 2017

---

**Abstract:** In this work the problems reducing effectiveness of activities of the situational center for liquidation of emergency situations in Kazakhstan have been revealed. For enhancement of the situational center activities the methods of the system analysis, business processes modeling, datalogical modeling, SADT technology, methodology of the balanced scorecard (BSC) are used. For the analysis purpose of the existing now business processes the model of the situational center (AS-IS) is developed, ineffective processes are revealed. For enhancement of the crisis center activities the reorganized business processes model (TO-BE) is offered by authors, the datalogical model of computer support of activities of the situational center is designed, the strategic map of actions in the conditions of emergency is developed. Theoretical developments of authors will allow to increase effectiveness of the situational center activities.

**Keywords:** Emergencies, Situation Centre, Operational Activities, Information Support, Model of Business Processes, Strategic Map, Intellectual Building

---

## 1. Introduction

The Emergency Situation (ES) is the situation in a certain territory which resulted from accident, disaster or catastrophic crash which entailed or can entail death of people, damage to their health, the environment and subjects to managing, considerable material losses and violation of conditions of activity of the population.

Protection of the population, the environment and business facilities against the emergency situations and consequences caused by them is one of the priority fields of carrying out state policy [4].

Losses from accidents, catastrophic crashes and natural disasters in the Russian Federation according to a number of experts, constitute 5-7% of gross domestic product. Russia annually loses more than 50 thousand of people's lives, more than 250 thousand of people are injured and maimed. On average, every day there are about 580 fires, which killed more than 40 people and as many more are injured. Daily property damage exceeds 20 mln of rubles. In the past decade it has increased significantly the risk of the techno sphere, which exceeds the risk of natural disasters: the human and

material losses caused by man-made factors affecting 4-6 times greater than the losses from natural disasters.

In the Republic of Kazakhstan only in 2014 it recorded 8254 emergencies, 1829 people were suffered and 598 people were killed.

Protection of population and territories from emergency situations around the world carried out by the state. For this purpose, in the different countries specialized bodies are created. The Federal Emergency Management Agency (FEMA) is a central link in the system of the United States executive public authorities in case of emergencies. FEMA is subordinated to the Ministry of Internal Security. In the Russian Federation Unified State System of prevention and liquidation of emergency situations (RSE) was established at the Ministry of Emergency Situations. It includes national and regional crisis management centers (CMC). There are two committees organized at The Ministry of Emergency Situations of the Republic of Kazakhstan: the Committee on the state control and supervision in the field of emergency situations of the Ministry of Emergency Situations of the Republic of Kazakhstan and the Committee on State Material Reserves of the Ministry of Emergency Situations of the Republic of Kazakhstan; there are established regional crisis

centers (RCC), crisis centers of cities (CCC), crisis centers in rural areas (RACC).

The situational (crisis) centers of the Republic of Kazakhstan are engaged in management of elimination of emergency at local level.

The number of the victims and extent of the financial losses from emergency depends on overall performance of these bodies. The threat of people life and significant material damage from emergency demands from the situational center staff of fast and exact decision making. However, the illegibility and heterogeneity of got information, unpredictability of the situation development considerably complicate management process. Due to this the need of computer support of the situational centers activities in the conditions of incomplete and indistinct information is obvious.

## 2. Problem Formulation

For enhancement of activities of the Karaganda crisis center of Ministry of Emergency Situations it is necessary to analyze the existing business processes of the organization, to reveal bottlenecks, to think over their reorganization, to develop models of business processes of activities in the conditions of emergency of AS-IS and TO-BE, strategic map of actions in the conditions of emergency, to design datalogical model of computer support of the situational center activities. These theoretical developments will form further base for implementation of computer support of activities of the Situational center of Ministry of Emergency Situations.

## 3. Methodology

In modern practice of management of organization activity to understand how it works, modeling is used. Business process modeling is process of reflection of subjective vision of the works flow in the form of the formal model consisting of the interconnected operations.

The purpose of modeling is systematization of knowledge of the organization and its business processes in the evident graphical form more convenient for analytical handling of the got information.

Business processes modeling is an important component of projects on reengineering (reorganization) of business processes and creation of large-scale systems of the software.

The main advantage of the idea of the analysis of the organization business processes by means of creation of its model is its universality. First, business processes modeling is an answer practically to all questions concerning organization activity enhancement. Secondly, the administration of the organization, implemented at itself specific methodology, will have information which will allow to enhance independently the activities and to predict the future.

Thus, for the solution of objectives methods of the system analysis, business processes modeling, datalogical modeling, SADT technology, balanced scorecard methodology (BSM) are used.

## 4. Research Results and Discussion

### 4.1. Analysis of Activity of Karaganda Crisis Emergencies Centers

The regional crisis center (RCC) is body of daily management of a regional territorial subsystem of the State system of Emergencies (SSE). Its purpose is ensuring activities for emergency situations on management in the field of civil defense, fire safety, industrial safety, safety of people on water objects, protection of the population and the territories against natural and technogenic emergency situations, management in accordance with the established procedure of activities by local executive bodies within SSE.

The analysis of activities of RCC allowed to reveal a number of the problems reducing its efficiency. These problems are united by authors in three groups: the region conditions (high seismic danger, a significant amount of emergency); organizational problems (low pay for work of young specialists, staff turnover, low skill level of personnel, shortage of resources); problems of information support (use of two disconnected, poorly structured databases in Excel and in Access in which not classified data are inputting).

The system in Access has the simplest data scheme and can be used only for new employees training. In a DB it is impossible to organize search of necessary information. Both systems aren't intended for the deep analysis and the forecast. The system in Excel allows to create the statistical reporting only. Data processing in it is extremely labor-consuming and inconvenient for users. Thus, the contradiction between the high need for information support of often changing not enough qualified personnel and a condition of the information support which isn't answering to requests at all is revealed.

The analysis of the available developments in the field of information support of operational activity of the situational centers of Ministry of Emergency Situations [1-3, 5, 6] is showed that the existing models are oriented to the description of development of emergency and the forecast of their consequences, models of resource management are worked insufficiently out, there is no accounting of the region specifics. Authors proved feasibility of carrying out scientific research in the direction of development of management models by operational activity of the situational center of Ministry of Emergency Situations and their computer implementation.

### 4.2. Business Processes Modeling of Activities of the Crisis Center of Ministry of Emergency Situations in the Conditions of Emergency Situation

On the analysis basis of subject domain, the model of business processes is constructed. A weak point of the AS-IS model is process of the situation analysis.

Emergency situation as object of management has the following specific features [6]:

a) Multidimensionality, a multilevelness and multiconnectivity of the processes characterizing emergency situation.

b) Uncertainty of parameters of development of emergency situation when required rates of liquidation, necessary amount of resources, level of complexity of the performed works aren't known.

c) Individual nature of development of specific emergency situation.

d) Need of decision making in short terms.

e) Large volume of data of different aspects and at the same time their low accuracy.

f) Limited opportunities of carrying out active experiments.

The system analysis of emergency situations as object of management allows to allocate the following main problems in the field of management in the conditions emergency:

- need of ensuring the set quality of management in case of heterogeneity and a poorly structured regulated processes;
- management processes in emergency are characterized

by a considerable share of uncertainty of information;

- in the conditions of the fast-proceeding emergencies an effective decision making needs to be performed in the conditions of limited time and in proportion to rates of increase of threat and the striking factors;
- the choice of the most informative parameters of emergency situation from all sets, admissible for the state parameters measurement.

On the basis of the subject domain analysis the business processes model is constructed (figure 1). Weak point of the AS-IS model is process of the situation analysis. The information system used in the situational center in Access DBMS allows to see reference information, but, first, information retrieval is impossible that leads to additional time commitment which is a critical factor in case of liquidation of emergency situations, and secondly, there is no decision support that is also an important factor.

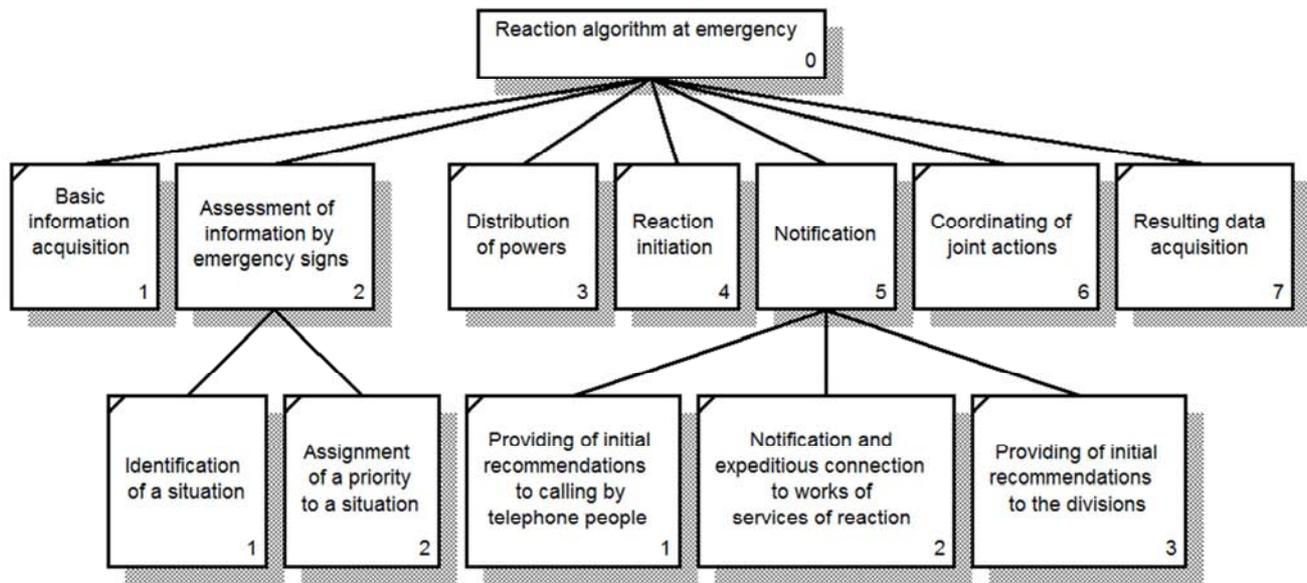


Figure 1. Business processes model of reaction of the Crisis center of Ministry of Emergency Situations in case of emergency situation (AS-IS). Node tree diagram.

Upgrade of the AS-IS model consists in addition of situation analysis process and its decomposition on the subprocesses: identification of an object state parameters, identification of the external environment parameters (threat) and identification of parameters of possible object of attack, which based on the computer support system use. The node tree diagram of business processes model of reaction of the crisis center of Ministry of Emergency Situations in case of emergency situation (TO-BE) is provided in the figure 2. On it the added processes are highlighted with dark color. Balanced Scorecard (BSC) has been applied for identification of necessary parameters.

The essence of the BSC consists in a strategy formulation in several prospects, statement of strategic objectives and measurement of objectives achievement extent by means of indicators. The methodology allows to consider balance between the purposes contradicting each other, and also between the

importance of a financial and non-financial indicators. Success in goal achievement is provided thanks to implementation of the balanced strategy. A lot of things can depend on correctly and clear formulated strategy. When a strategy was formulating on the basis of BSC the emergency response service activities were considered within five prospects: functional, financial, ecological, humanitarian and common.

The choice of key indicators-rather responsible and ambiguous process. Especially it belongs to non-financial indicators. Determination of non-financial indicators is rather difficult because of their ambiguity. Consideration of various prospects during the forming and strategy implementation is characteristic feature and a crucial element of the balanced scorecard concept. The formulation of strategic objectives, choice of indicators and development of strategic actions for several prospects are designed to provide comprehensive consideration of activities in the conditions of emergency.

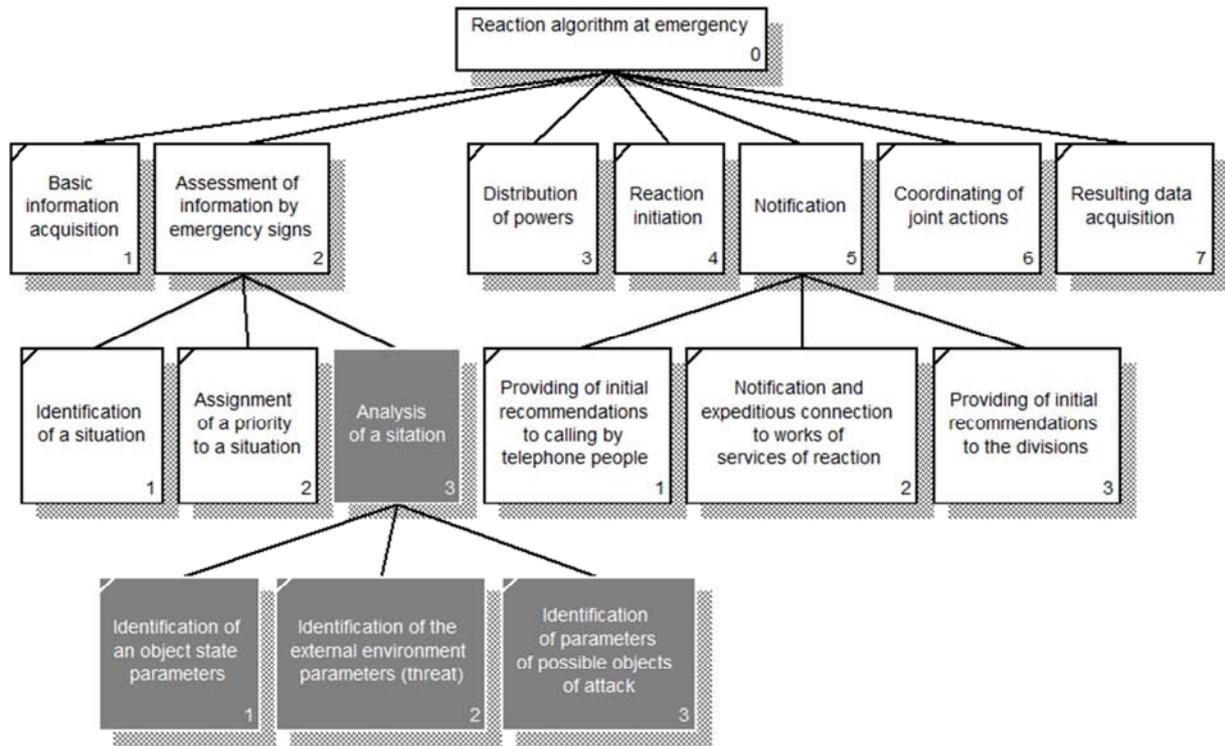


Figure 2. Business processes model of reaction of the Crisis center of Ministry of Emergency Situations in case of emergency situation (TO-BE). Node tree diagram.

Development of the BSC is performed by accomplishment of the following steps:

- specification of strategic objectives;
- linking of strategic objectives by cause and effect chains-creation of a strategic map;
- choice of indicators and determination of their target values;
- determination of connection of indicators with business processes;
- development of strategic actions.

Strategic objectives have the status of the decisive and key purposes. To plan and provide implementation process of the purposes, the corresponding financial and non-financial indicators are developed for each of them. For indicators, in turn, target, planned and actual values are determining.

At a development stage of BSC it is necessary to consider that strategic objectives, but not their indicators, are the center of the balanced scorecard. Strategic objectives describe the planned results. Each strategic objective is connected with one of the prospects of the emergency response service activities.

The choice of the most important purposes is based on the following criteria:

- The purposes shall be measurable.
- It is possible to influence goal achievement.
- The purposes are acceptable for various divisions and are approved with a common goal of emergency response service.

Strategic objectives aren't independent and torn off from each other, on the contrary, they closely with each other are connected and influence at each other. Achievement of one purpose serves achievement another and so on, to a main

goal. Connections between various purposes are clearly visible thanks to a cause and effect chain. Those of them which don't make a contribution to implementation of a main goal are excluded from consideration.

Apply a strategic map to graphical display of interrelation of strategic objectives and prospects. The strategic map displays the key purposes providing successful implementation of strategy. The main function of the card-cause and effect display of the purposes in strategy implementation process.

On the basis of the stated principles the strategic map of actions in the conditions of emergency is developed by authors (figure 3).

Information structure of organizational processes of emergency liquidation was researched for the purpose of the system datalogical modeling. It is characterized by a variety of organizational processes, which is performed by the following types of knowledge:

a) Poorly structured knowledge of elimination of emergency situations which presented by following facts:

- standard scenarios of development and elimination of emergency situations;
- knowledge of technogenic objects as danger sources;
- liquidating plans;
- experience of experts in elimination of emergency situations.

b) The formalized data:

- about the happening earlier emergency situations;
- about parameters of danger sources;
- about forces, means and resources of emergency situations elimination;
- about the protected objects;

- about life support systems;
- about objects and means of protection;
- about forms and attributes of documents on emergency situations.

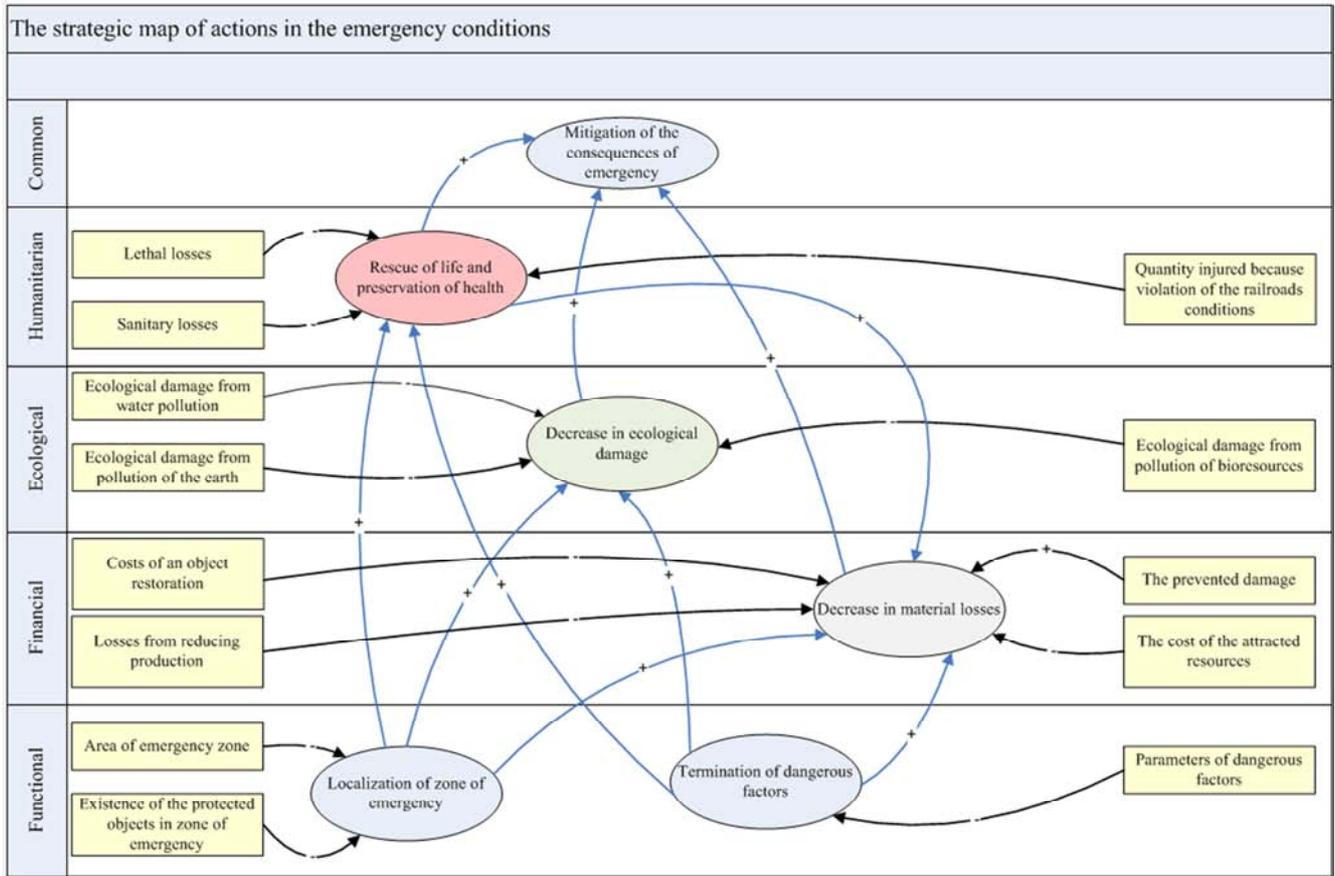


Figure 3. A strategic map of actions in the emergency conditions.

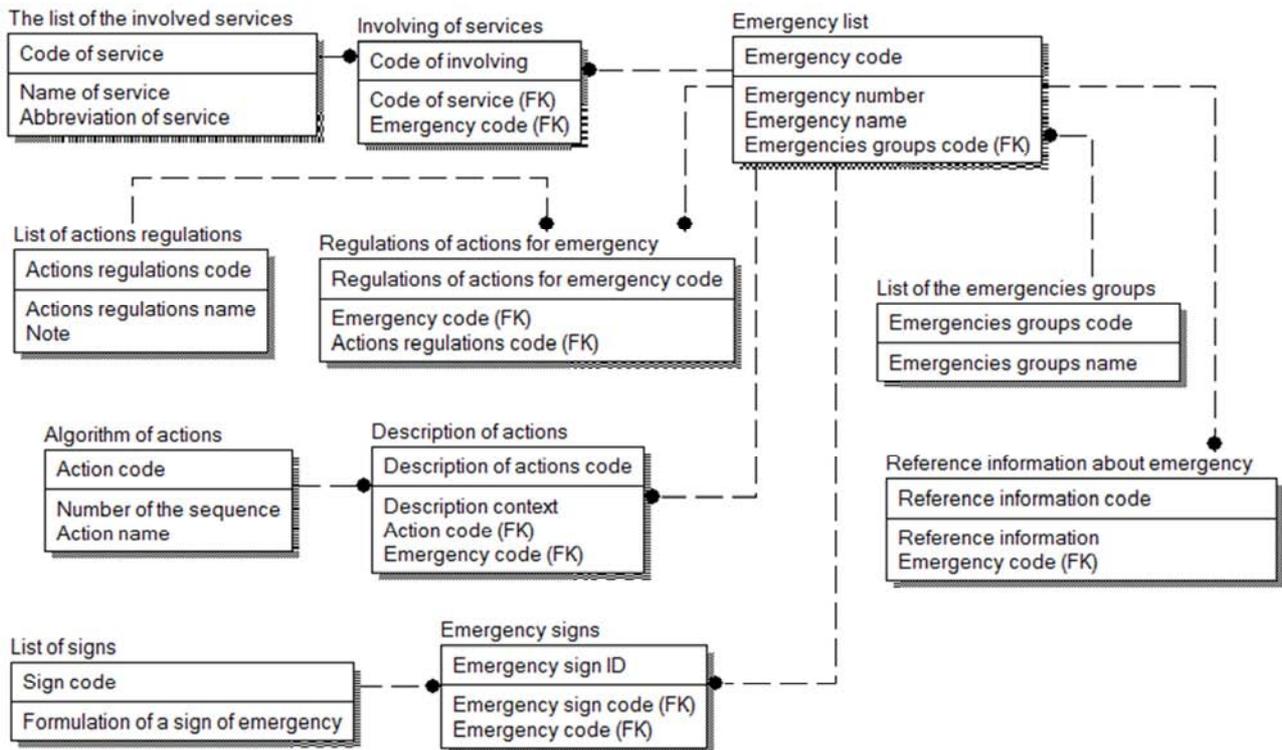


Figure 4. Datalogical model of computer support system of activities of the Crisis center in the emergency situation conditions.

The datalogical model of computer support system of the crisis center activity in the conditions of emergency situation is displayed in the figure 4.

## 5. Conclusion

Authors revealed the problems reducing efficiency of activities of the Karaganda crisis center of Ministry of Emergency Situations. All problems are divided into 3 groups. Problems of the first group are caused by a region condition from the point of view of emergency probability. Problems of the second group are of organizational nature. Problems of the third group concern information support of the crisis center activities. For the purpose of the analysis the model of existing business processes of the crisis center (AS-IS) is developed, the model of the reorganized business processes (TO-BE), datalogical model of computer support of the crisis center activities is offered, the strategic map of actions in the emergency conditions is developed. Theoretical developments of authors will allow to increase efficiency of activities of the crisis center of Ministry of Emergency Situations.

---

## References

- [1] Esmagambetov T. U., Shikul'skaya O. M. Analysis of information support of the Karaganda regional crisis center activity / Materials of the X International scientific and practical conference, «Conduct of modern science», -2014. Volume 24. Technical sciences. Physical culture and sport. Sheffield. Science and education LTD-pp. 29-31 [in Russian].
- [2] Esmagambetov T. U., Shikulskaya O. M. Analysis of problems of activities of the situational center Ministry of Emergency Situations / Modern science: urgent problems and ways of their decision. 2014. No. 12. P. 78-80. [in Russian].
- [3] Esmagambetov T. U., Shikulskaya O. M. The analysis of problems of management of operational activity of the situational center Ministry of Emergency Situations in Kazakhstan / Technical science - from the theory to practice. 2014. No. 40. P. 34-38. [in Russian].
- [4] The law of the Republic of Kazakhstan of 05.07.1996 N 19-І "About emergency situations of natural and technogenic nature" [in Russian].
- [5] Teterin I. M., Topolsky N. G., Matyushin A. V., Svyatenko I. Yu., Chuhno V. I., Shaposhnikov A. S. Control centers in crisis situations and notifications of the population: The education guidance, under edition of the Doctor of Engineering of professor of Topolsky N. G. – M.: GPS Emercom of Russia academy, 2009. – 272 pages [in Russian].
- [6] Yamalov I. U., Modelling of management processes and decision making in the conditions of emergency situations [An electronic resource] / I. U. Yamalov. — 2nd prod. (эл.). — M.: BINOMIAL. Laboratory of knowledge, 2012.-288 pages: silt. - ISBN 978-5-9963-0839-2 [in Russian].
- [7] Kosko B. Fuzzy Cognitive Maps // International Journal of Man-Machine Studies, 1986.-Vol. 1.-P. 65-75.
- [8] 220 Kosko, B. Fuzzy Engineering, Prentice-Hall, New Jersey, (1997).
- [9] 221 Margaritis M., Stylios Ch., Groumpos P. P. FSM Analyst-A Fuzzy Cognitive Map Development and Simulation Tool // Workshop on Computer Science and Information Technoloies (CSIT'2002), Patras, Greece, 2002.-pp. 156-162.
- [10] 223 Pilishkin V. N. General Dynamic Model of the System With Intelligent Properties in Control Tasks // Proc. of the 15th IEEE International Symposium on Intelligent Control (ISIC-2000), Rio, Patras, Greece, 17-19 July, 2000.-P. 223-227.