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THREATS MANAGEMENT PRINCIPLES FOR DEVELOPMENT PROGRAMS OF HIGH TECHNOLOGY INDUSTRIES IN TURBULENT ENVIRONMENT

Abstract. The article discusses principles of management of threats in organisational development programmes, based on the conceptual model of "uncertainty – threat – risk". Analyses the current models of threats is carried out, based on the examples from high-tech industries and methods of managing programmes of development within them. Case studies are presented focusing on three models – one for each of organisational levels – institutional, managerial and technical. In addition, classification of threats in management of development programmes in high-tech organisations is carried out, based on their response mechanisms – reactive and proactive. The immune mechanism, as a response to threats and challenges in development programmes is also considered. Alternative scenarios of managing threats are developed within the article, based on full immune response to critical threats which belong to Pareto set. Finally, seven keys to success are identified using as an example innovative programme management in the development of system of public finance in the environment of external and external threats and shocks.

Keywords: threats management principles, management mechanism, development programs, turbulent environment, immune response

ZAGROŻENIA DLA ZARZĄDZANIA PROGRAMAMI ROZWOJU PRZEMYSŁU WYSOKICH TECHNOLOGII W BURZLIWYM ŚRODOWISKU

Streszczenie. W artykule omówiono zasady zarządzania zagrożeniami w programach rozwoju organizacyjnego na podstawie koncepcyjnego modelu „zagrożenia niepewnością i ryzykiem”. Analizuje się w nim dzisiejsze modele zagrożeń oparte na przykładach przemysłu high-tech oraz sposoby zarządzania programami rozwoju w tych przemysłach. Studia przypadków są prezentowane na podstawie trzech modeli – po jednym dla każdego z poziomów organiza-

cyjnych – instytucjonalne, kierownicze i techniczne. Ponadto, wykorzystując mechanizmy reagowania – reaktywne i proaktywne – przeprowadza się klasyfikację zagrożeń w zarządzaniu programami rozwojowymi w organizacjach high-tech. Uwzględniany jest również mechanizm immunologiczny jako odpowiedź na zagrożenia i wyzwania w programach rozwojowych. W artykule opracowano alternatywne scenariusze zarządzania zagrożeniami przy wykorzystaniu pełnej odpowiedzi immunologicznej na krytyczne zagrożenia należące do zestawu Pareto. Wreszcie w publikacji zidentyfikowano siedem kluczowych czynników w procesie innowacyjnego zarządzania programami rozwoju systemu finansów publicznych w środowisku zewnętrznych i wewnętrznych zagrożeń oraz wstrząsów.

Słowa kluczowe: zasady zarządzania zagrożeniami, mechanizm zarządzania, programy rozwojowe, burzliwe środowisko, odpowiedź immunologiczna

1. Introduction

Global financial crisis and threats and shocks to the system that followed as a result of it, gave rise to initiation of the whole range of innovations within development of organisations. Non-linear processes, which take place as a result of pressure of turbulent environment, create the need for the development of adequate response models, enabling organisations to react to uncertainty, organisational risks and threats and to develop strategies to provide stability of the development processes. In this case, threats management play important roles in success of development programs.

Worldwide economic crises became a mighty initiator of numerous projects focused on the development of organisations, changing the views on the linearity of processes of internal and external interrelations. It became clear today there is a need for a new philosophy and models for management of threats within the development of high-tech organisations.

In the environment of crises and turbulence of business-environment of the high-tech environment, professional project management, as an instrument leading to competitive advantage, has become of paramount importance. In a situation like this, new scientific findings related to the identification of threats and their elimination, which formed as a result of various methods of organisational research, allow managers to find rational solutions that provide stability of development. Development of high-tech organisations is related to realisation of the strategy of programme and project management. In this process, an effectiveness of management of high-tech organisations is a key factor, which forms its competitiveness in the environment of globalisation of markets. Development of organisations in the modern dynamic world takes place under the influence of internal and external market turbulence, caused by the crises issues, both within the country where the organisation is based and outside of it. Non-linear influences on the organisation are formed as a result of turbulence of the environment and lead to a need for the creation of adequate

models for management of threats and shocks caused to organisations by such environment in order to realise strategies of stable development. In the process of development of appropriate models for organisational development in turbulent environment, understanding of formation and development of organisational competence is of paramount importance. Successful mechanisms of formation of organisational competence are linked to the integration of competences in project management and operational activity of the organisation. The current task in hand is the diagnostics of organisational threats and creation of methods of proactive responses based on development of competences in project management using both project and operational activity of the organisation in a dynamic environment. The process of knowledge transfer from one domain to another was formed in the 1950s, within the similarity theory of mechanical, electrical and biological systems.

In this paper, we present threats management principles based on comprehensive model "uncertainty-threats-risk" to managing successful development programs.

2. Analysis of recent achievements and publications

Let's consider the use of different methods of threat analysis, including self-test, in the development of project-oriented systems.

Diagnostics in the context of life cycles analyses of products, technologies of production, management processes of operations, business development and implementation, is usually carried out in the framework of management system using the model of the project-oriented organization life cycle¹. When threats of an organisation analysed, whether this is done by personnel themselves, or using the help of specialised consultants, it determines the position of the organisation in its development, its passed crisis points and its expected further development². In the process of forming a development programme for high-tech production, complementary chains of projects are formed based on certain horizons of vision. At each step of the process there is a clarification of project's vision and corresponding synchronization.

The use of diagnostic tools depends on the development strategies for the project-oriented organization and the state of the context. Thus, the strategy of a breakout in the development of new markets and the competitive edge is stipulated with the high level of innovation of influential competitor in the market segment of knowledge-intensive industries. Identification of positive reaction in management processes is one of the elements of the concept of growth cycle and allows to look at the balance of efforts and dynamics of competition in current market conditions, to identify and classify growth accelerators – factors that ensure

¹ Prigogine A.: Methods of organizations development. MCFER, 2003, p. 93-104.

² Azarov N.: Innovative principles for managing development programs. Summit-book, 2012.

sustainable development of high-tech industry, and to provide managers with a new tool for modelling corporate strategy³.

When analysing threats, an organization is considered at the following levels:

Institutional level, which is the top management, which forms the purpose of high-tech enterprise, planning strategy, business implementation and development of organisation. This level of management is carried out by the top managers or top executives. The competence level of these managers is important decision making for the company as a whole. Top managers are mainly involved in the development of perspective plans and long-term programs focused on company adaptation to changes in the external environment as well as a definition of applied methods, tools, technologies and systems to improve performance of organisation's business and productivity of the enterprise' employees as a whole.

Managerial level, which is the middle management, intermediate between strategic management and routine for implementation of the current tasks of the enterprise. The competence level of this management is determined by decision-making within the subdivisions of the enterprise and the realisation of its tactical objectives. Middle managers are typically in charge of subdivisions and/or departments within organizations. These managers are mainly engaged in management and coordination of high-tech enterprises. They make decisions on various forms of activities and efforts of various departments.

Technical level is the lower management, which is directly involved in supervising production staff. Managers at their level generally supervise the implementation of production objectives, deal with daily operations and the actions needed to ensure efficient work without disruption in business processes.

One the key tools for threat analysis in the development is *structuring*.

The following examples of project structures may be considered:

- tree of objectives,
- tree of tasks (work),
- tree of products (results),
- problem tree,
- decision tree,
- work breakdown structure,
- organizational structure of the project,
- and so on.

The structures are developed on the basis of analyses of systems and models. One of the primary methods of structural analysis is decomposition. Decomposition is a conditional technique that allows to introduce a system in a useful form and assess its complexity. As a result of decomposition individual structural elements of a system and the relations between them are categorised based on their characteristics. Modelling is a way of avoiding threats in high-tech industry through the development of an understanding of a system.

³ Kerzner H.: In search of excellence in Project Management. VNB, 1998, p. 274.

The depth of decomposition is determined by the order and complexity of a system, as well as the objectives of the task in hand.

The use of structural models leads to the requirement for their classification. Classification of objects represents their conditional grouping by given characteristics in accordance with a certain purpose. For various purposes, same organizational threats may be classified differently. The classification is not an end in itself, it is imposed by the theory and practice needs. Efficient classification of models provides convenience when choosing methods of modelling threats and achieving desired results.

Initialization conditions of high-tech industries development projects depend on the sources of its creation. As any living organisms projects are born, realized ("live") and completed ("dead") according to certain laws. It should be noted that the projects are not "born" accidentally. Every "new-born" project has its own story, "background" and "genetics".

The use of biological analogies, as suggested above, in project management mechanisms allows to use and transfer knowledge and experience from biological science. Development of this science, although it is a descriptive science, offers an excellent opportunity to detail the fields of project management methodologies that are not yet considered.

The analogy allows the use of relative structure and configuration of objects in one subject field to create "skeletons" for the detailed elaboration of structural features of objects in the field being studied. As an example of this biological concept of "genetics" and "immune mechanism" are being used in the field of project management.

The purpose of "genetics" project as a science was to identify the general laws of the transfer of knowledge from one project to another. For this, specialists had a task of identifying the mechanisms underlying the laws of genetics and associating them with project structure elements. In the process, the question came up about how and in which manner the project and its "genetic information" may turn into characteristics of the developing project. "Genetic information" of a project covers the whole range of features and characteristics that the project has during its lifecycle, from the moment of its "birth" until completion. Each project exists in its own environment and the formation of its structural features occurs in well-defined conditions, with each structure dependant not only on "hereditary background", but also on the conditions in which the structure is implemented and developed on the basis of the "model of the environment."

During its growth, each organisation is faced with particular difficulties, challenges and threats. At each stage of organizational development these can be divided into two categories⁴:

- growth threats, i.e. problems caused by the immaturity of an organization, which are difficult to avoid (like children's infectious diseases),
- organizational threats (internal and external), or difficulties which may relate to certain phases of organization's development.

⁴ Adizes I.: Integration: to survive and become stronger in times of crisis. Alpina Business Books, 2009, p. 128.

If correct strategy and tactics of development are used, the high-tech production can achieve prosperity and, in principle, remain in this state for a long time, contrary to the analogy between the development of a business organization and a living organism⁵.

The modern practice of system creation and development in project management shows that each methodology is formed from scratch. As such the same mistakes can be repeated many times. Project management methodology is regarded as a primary tool for development, control of organizational “disease” and formation of its competitive advantage. It is argued that creation of a knowledge management system of project portfolios and program management methodologies are a promising research trend. The use of knowledge of protective (immune) mechanisms in the living world in the construction of methodologies, allows the use of the immune system structure, as a knowledge-carrier of project management methodologies of the high-tech industry. This structure allows to divide the knowledge of methodologies into classes and to use that knowledge in creating effective project management methodologies that are adapted to the specifics of the enterprise and classes of projects and programs⁶.

3. The purpose of the study and problem formulation

The purpose of the article is to introduce application of threats management principles to managing successful development programs based on the conceptual model "uncertainty-threats-risk".

The aim of the article is to build a mechanism for the development of programs for threat management in a turbulent environment.

1. To analyse existing mechanisms of threat diagnostics in programs of development.
2. To classify threats (external – internal; by zones of turbulence with reference to the book⁷, by expected losses in the system during program implementation).
3. To build a conceptual model which will include mechanisms for diagnosis of threat-response mechanisms in the development programs of high technology industries.
4. To create a case study through development programs of high-technology industry in a turbulent environment.

The main hypothesis of the study is that the key factor of success of high technology industry development programs is development and use of diagnostic and threats management mechanisms.

⁵ Bushuyev S.: Organizational pathology project management. “Management of Development of Complex Systems”, No. 10, 2012, p. 5-8.

⁶ Azarov N.: op.cit.

⁷ Yaroshenko F., Bushuyev S., Bogdan T.: Crisis management of finances in the face of uncertainty. Summit-book, 2012, p. 168.

4. Conceptual model of analyses programs threats

The following structure of the threat classification is used, by classification features⁸:

- those concerning the organization – external, internal threats,
- those concerning the environment – by turbulence zones: green, yellow, red, brown and black,
- those concerning expected losses in the system during program implementation: insignificant, essential, destructive for the organization.

The conceptual model for analyses of program threats defined during project life cycle. Basic principles of conceptual model are:

- model must take in account uncertainty, threats and risks. These three system attributes are interconnected and create comprehensive of threats management model on the development program life cycle,
- model must take into account interactions between uncertainty, risks and threats (fig. 1).

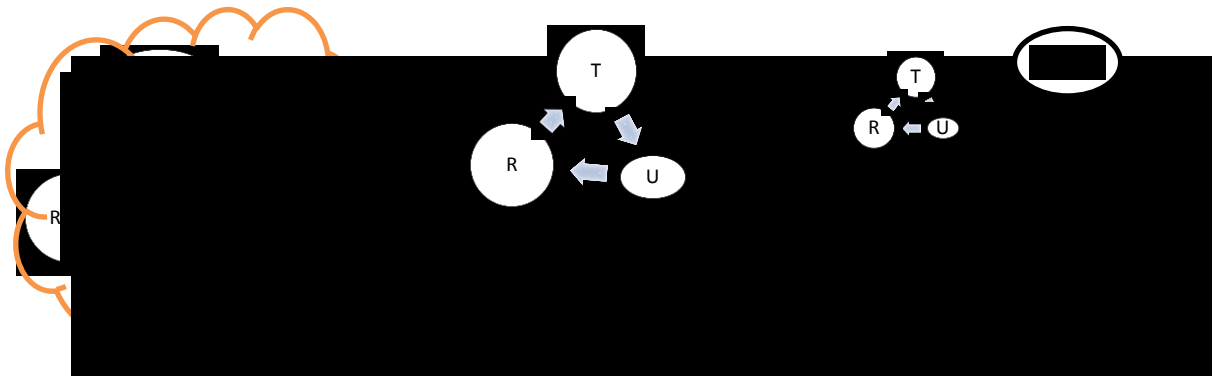


Fig. 1. Conceptual model for analyses of program threats

According to the proposed concept at the start of the process, there is big uncertainty, small risks and threats with vision 'in cloud'. In the next phase, uncertainty becomes smaller while risks and threats become realistic. At the end of the program there is a transformation from risks and threats of program to products while uncertainty becomes zero.

⁸ Ibidem.

5. Management of threats in developed programs

5.1. Modelling of threats to an Industrial High Technology Enterprise

Currently, there is not much literature dedicated to the problems of threats to industrial high technology companies, in spite of the fact that they are the riskiest businesses. For an efficient organization of risk management at industrial enterprises, it is necessary to develop a classification of threats.

Analyses of the literature showed a lack of clear and structured integrated classification of threats in an Industrial High Technology Enterprise (IHTE). Therefore, classification of threats in accordance with the functional components of IHTE was proposed. With this in mind, an enquiry form, which included the main threats of IHTE was drawn up and an expert survey was performed.

The views of experts in the field from the leading industrial enterprises were gathered.

Analysis of the proposed threats classification of IHTE was carried out using the weighting coefficients obtained by the expert methods of estimation. The experts were asked to rank the threats to IHTE in order of importance. In this case, 10 experts were interviewed according to each threat to each of the IHTE functional components.

A criterion of estimation was the significance (weighting) of risk, i.e. which of the listed threats to IHTE were considered by the experts to be the most and least important for the stable operation of the company.

The first rank was assigned to the most significant threats to the IHTE.

As rank increased the significance of threat decreased. The last rank (depending on the number of threats in the functional component of IHTE) was assigned to threats which were considered to be of least importance for an enterprise.

After processing the inquiry form for each indicator, the rank total (R_i) was calculated taking into account the opinions of all the experts:

$$R_i = \sum_{j=1}^N r_{ij}, \quad (1)$$

where r_{ij} is the i -th threat rank assigned by the j -th expert.

To move from the rank estimates $r_1, r_2 \dots r_n$ to the weight coefficients (a_i) Fishburn's formula was used, as follows⁹:

$$a_i = \frac{2(n-r_i+1)}{n(n+1)}, \quad (2)$$

where n is the number of estimated threats.

This formula was used because it assumes linear weight decrease from rank to rank.

⁹ Luce D.R., Marley A.J., Che Tat Ng, Brams S.J., Gehrlein W.V., Roberts F.S.: The Mathematics of Preference, Choice and Order: Essays in Honor of Peter C. Fishburn. Springer, 2009, p. 278.

Table 1 shows the classification of IHTE threats obtained as a result of the expert survey and calculated weighting coefficients.

An important point of the expert procedures is the evaluation of experts' action concordance and reliability of expert scores.

To determine this, the coefficient of concordance was used. The value of this ratio gave an indication of the degree of concordance of expert opinion and, consequently, of the reliability of their scores.

Table 1

Results of the expert survey

Functional component of IHTE	Classification of threats to IHTE	R_i	rank	a_i
1. Finance	Objective:			
	1. Circumstances outside one's control or similar to them in themselves or in sources of appearance.	34	3	0,2
	Subjective:			
	2. Inefficient budgeting of all aspects of activity	20	2	0,3
2. Production	3. Unqualified enterprise asset management	10	1	0,4
	1. Non-conforming production (non-compliance with requirement of time, unable to manufacture competitive products)	14	1	0,4
	2. Non-conforming supplier of components, raw materials, expendable materials etc.	16	2	0,3
	3. Insufficient awareness about innovative technologies	36	4	0,1
3. Marketing	4. Inappropriate infrastructure	34	3	0,2
	1. Limited market for final product	25	2	0,24
	2. Non-compliance of the products with market requirements	13	1	0,29
	3. Risks related to market development	39	4	0,14
	4. Insufficient awareness about changes in the market	53	6	0,05
	5. Non-professional advertising	45	5	0,1
	6. Risks related to market conditions (exchange rate risks, price variance risks, competitive expansion risks)	35	3	0,19

From the above, the coefficient of concordance (W) is determined using the following formula (3):

$$W = \frac{12 \sum_{i=1}^n (\sum_{j=1}^N r_{ij} - \frac{N(n+1)^2}{2})}{N^2(n^3 - n) - N \sum_{j=1}^N L_j}, \quad (3)$$

where:

N is the number of experts,

r_{ij} is the rank of the i -th threat assigned by the j -th expert,

L_j is an indicator of related ranks of the j -th expert.

L_j value is determined by the following formula:

$$L_j = \sum_{v=1}^{k_j} (k_{jv}^3 - k_{jv}), \quad (4)$$

where:

k_{jv} is the number of the same ranks in v group of the j -th expert,

k_j is the number of groups of indicators with the same ranks of the j -th expert.

The coefficient of concordance W can vary between 0 (where there is a complete lack of concordance) and 1 (in the case of agreement of the ranking results of all experts). The degree of concordance of expert evidence is considered acceptable if $W \geq 0,7$.

Table 2

The results of experts' opinions concordance

Functional components of IHTE	Coefficient of concordance
1. Finance	0,9
2. Production	0,81
3. Marketing	0,59

Table 3 below shows the most significant threats to IHTE, which were found according to the experts as a result of the calculations

Table 3

Most significant threats to IHTE

Functional component of IHTE	Threats names of IHTE
1. Finance	Inefficient enterprise asset management
2. Production	Imperfect production (noncompliance with requirement of time, unable to produce competitive products)
3. Marketing	Noncompliance of the products with market requirements

Ensuring compliance of each functional component of IHTE with requirements may be achieved by carrying out an individual set of measures for each component.

It was noted that all of the functional components of IHTE were closely interrelated and hence it would not be possible to achieve stability of an enterprise through adjusting just one of these components, without bringing the others to the required level.

By expert survey mentioned above, classification of industrial enterprise threats was proposed for practical use, allowing develops directions for the preventive measures to ensure the stability of the industrial enterprise.

5.2. Case Study 1. Assessing and developing organisational competence in projects with high risks and threats as seen at Chernobyl Nuclear Power Plant (ChNPP)

In the 1980s, ChNPP was one of the most powerful nuclear power plants in the USSR. According to the strategic development plans of power industry of the Soviet Union, the ChNPP had to become the largest nuclear power plant in the world, consisting of six power

units with an electric power of 1000 MWt each (corresponding to 3200 MWt of thermal power each respectively).

However, the devastating explosion of the fourth power unit of ChNPP on 26 April 1986 changed everything. The accident caused an emission of a huge amount of radioactive materials into the environment. About 600.000 people participated in the elimination of consequences of the largest accident in the history of nuclear power, 200.000 people were evacuated and moved out of the area, and the health of 1.7 million people was undermined. The death-toll related to the Chernobyl accident, including those died from cancer years later, according to official data sources was estimated at 125.000 people.

In 1986 in just six months, in difficult radio-active conditions, scientists and experts of the former Soviet Union designed and constructed a protective cover for the damaged reactor, which was named the "Shelter", and was later renamed to "Sarcophagus". Implementation of design decisions during construction of "Shelter" object in a difficult radiation situation demanded implementation of a range of organizational and technical actions to ensure radiation protection of the personnel. Practical implementation of the fundamental principles of radiation safety while carrying out dangerous works was reliably supported by the strictest discipline and quickly developed and put into practice instructions and regulations of the performance of all radiation-hazardous works.

In 1994 political leaders of the world, represented by the G7 and the European Union requested that the Ukraine stops operations of the remaining nuclear power stations of ChNPP. In 1995, the Ukraine signed a Memorandum of Understanding to stop power units of the ChNPP which eventually happened in 2000. A year later, the State Specialized Enterprise Chernobyl NPP (SSE ChNPP) was formed by the Ukrainian Government to decommission the existing power units and to transform the "Sarcophagus" into an ecologically safe system.

A complex three-stage program was started. In Stage 1 the objective was to stabilize the existing "Shelter" by increasing reliability and durability of the old structures and systems. Stage 2 was aimed at creating additional protective barriers, firstly through creating a new safe confinement providing necessary conditions (e.g. to ensure safety of the personnel, the local population and environment), preparatory technical work and the infrastructure for stage 3. This included erection of the "New Safety Confinement (NSC)", which was an arched construction with a width of 257.4 metres, a height of 108.4 metres and the length of 150 metres. The NSC was designed for 100 years of operation to give the chance to carry out extraction of fuel-bearing materials and their conditioning for the subsequent safe storage (fig. 2).

After the erection of the NSC in 2015, stage 3 would start and is planned to be carried out by 2023. It is aimed at the extraction of fuel-bearing materials and long existing radioactive waste, their conditioning and burial in radioactive waste storages in accordance with existing standards, removal from operation of the "Shelter" and dismantling of unstable structures of the "Sarcophagus".



Fig. 2. NSC after second lift of eastern section in 2013.

Financing of works on the international project (the plan of implementation of measures on "Shelter" object) is carried out at the expense of the donor countries of the international Chernobyl Fund "Shelter" (ChFS). The European Bank of Reconstruction and Development (ERDB) provided the help to the government of Ukraine in organising of the international conference on fund-raising to cover the missing financing of the program. As a whole, the construction of the NSC arch is expected to cost over of 1 billion Euros.

One of the challenges for the ChNPP was the lack of personnel with sufficient experience in implementing such a complex program and with coordination of all related projects. A Project Management Unit (PMU) was formed to establish standards for project and program management in accordance with the internationally acknowledged standards¹⁰. The PMU of ChNPP worked closely together with Ukrainian Project Management Association (UPMA) and Kiev National University of Construction and Architecture to develop the standards and the competence of personnel involved in the program and projects with the application of IPMA OCB model¹¹.

5.3. Case Study 2. Key threats within the innovation program of ukrainian public finance system

What does it mean to be successful in this dynamic and often turbulent world? The answer to this question is complex. To be dynamic? Not only that... There is a need to be proactive and focused on value creation, by using the trend of passing to the economy of knowledge, making timely changes in management pattern and understanding the philosophy of life cycles. It is important to reload the system in time, to be creative, to develop knowledge and perfection centres. Each of these elements is a key to success, and the formula for success is determined by their interaction. The keys to success of projects and programs of complicated systems` reformation form the development programs` management methodology, defined in the following sections.

¹⁰ Bushuyev S., Wagner R.: IPMA Delta and IPMA Organisational Competence Baseline (OCB): New approaches in the field of project management maturity. *International Journal of Managing Projects in Business*, Vol. 7, Iss. 2, 2014, p. 302-310.

¹¹ IPMA Organisational Competence Baseline (IPMA OCB). IPMA, 2013, p. 67.

The Keys to successful reformation of complicated systems, using public finance system of Ukraine¹² as an example, are considered below, with the focus on their mechanisms and methodology.

6. Keys to successful program management

6.1. Key 1. Be proactive

6.1.1. *Have a formalized model of the future*

Ministry of Finance of Ukraine devised and applied a model of proactive management of public finance development shown on fig. 3¹³.

This model was constructed by taking into account potential falls in the critical points (points of bifurcation) in public finance development and allowed creation of a program that took into account critical events and focused on success¹⁴. Analysis of the model shows that, within the first two years of the start of the implementation of the program, there were potential crises in the following segments: transition to professional management in the course of administrative reforms, autonomy at the local budgets, relations of "centre – regions" and manageability. All of this resulted in the loss of trust (critical point 6).

Figure 3 focused on the segment of 2010-2011, where actions had been relating to the critical points of the model given below.

The Government plans were to apply three models of fiscal policy: 2010 – economy of patience; 2011 – transition from economy of patience to stabilization and development; 2012-2014 – driving force of building a competitive economy, based on social orientation through stimulation of production and consumption chains by focussing on proactive nature of the development of medium-term planning model, decentralisation of revenues and expenses and the support of investment and innovative model of development of Ukraine.

¹² Yaroshenko F., Bushuyev S., Bogdan T.: op.cit.

¹³ Azarov N.: op.cit.

¹⁴ Adizes I.: op.cit.

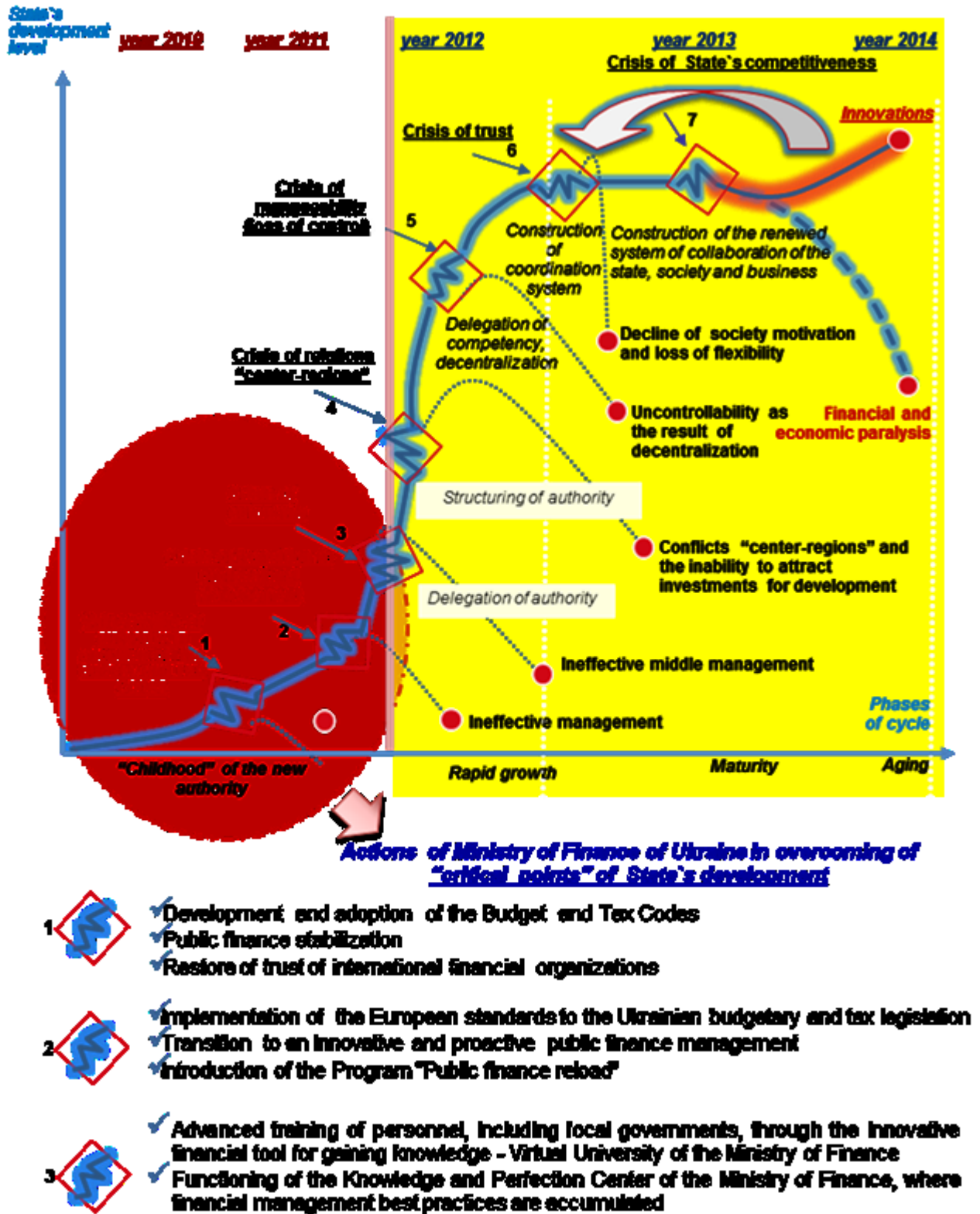


Fig. 3. Model of proactive program management of public finance development

6.1.2. *Look into the future*

Whenever a new project or program starts, we are typically faced with the following questions:

What is the future? What should be expected? How to assess the vision of the future within reach, uncertainty, threats and risks on the way and results?

An effective manager must be a "visionary" because only a vision of the future product and its implementation can ensure success of the project¹⁵.

6.1.3. *Understand and use the trends*

Management based on trends makes the process proactive. The art and science of analysing trends is a method that a team uses in the process of management development, by generating and analysing of the new ideas or development strategy.

Trends never arise out of nothing and never stop without reason. One of the trends that accompanied the development of Ukraine, for example, was a "demographic hole" created by the decline in fertility during the restructuring and formation of independent Ukraine. The strategies for responding to this trend included an opening of borders for labour migration, trend-oriented economic conversion, promoting fertility etc.

The integrated influence coefficient is based on hypotheses about the conditional independence of the influence of trends or its groups on the budget of Ukraine and the consequences of the lack of time.

6.2. Key 2. Focus on value creation

As an example of this, a new model of fiscal and target programs management is considered. Instead of budget allocation, it focuses on value creation for the parties concerned. In this regard, it becomes necessary to determine the structure and components of what constitutes value for key stakeholders, develop estimation methods for models and values (assets, skills, knowledge and innovation) and implement models and methods using the methodology of management of innovation development.

In addition, the goals set out have to be coordinated with the mission of public finance system. They have to become the driving force of reforms and economic development of Ukraine on the basis of innovative management techniques¹⁶.

6.3. Key 3. Move towards a knowledgeable economy

As an example of this, a model of knowledge and excellence is considered. It is based on project approach, cognitive models of accumulated knowledge and technological maturation. These elements constitute the basis of the conceptual model of innovative development¹⁷.

¹⁵ Azarov N.: op.cit.

¹⁶ Bushuev S., Bushueva N., Babayev I., Yakovenko V., Grisha E., Dziuba S., Voitenko A.: Creative technology for management projects and programs. Summit-Book, 2010, p. 768.

¹⁷ Neizvestny S., Kharitonov D., Rogozina V.: Algebra of Project Management methodologies based on the genomic model. "Management of Complex Systems Development", No. 15, 2013, p. 46-48.

6.4. Key 4. Change the management model by creating and implementing formula for success

Making this key successful was achieved through:

- formation of the vision of life cycles of products, processes and systems,
- development of a formula for success based on trends and new philosophy management,
- implementation of a new management paradigm.

6.5. Key 5. Form a thinking space and be creative

The main mission of creating a thinking space based on teamwork, innovations and stakeholder satisfaction is to create an efficient and technologically mature system. An example of this was demonstrated by the Ministry of Finance of Ukraine, which developed a conceptual scheme of creative model, forming the basis of the accepted approach based on the public finance system.

6.6. Key 6. Carry out system reload

As an example of this, a structure of a programme was developed by the authors. This structure consisted of three main blocks: the basis, projects (programs) and innovative mechanisms.

As an example, successful implementation of such large-scale reforms in public finance system of Ukraine created the need for rapid, high-quality and effective training of all staff involved in the public finance system. In response to this, the Virtual University of the Ministry of Finance was established. The Virtual University is successfully operating and currently more than 100 thousand public civil servants are training and taking the independent testing there.

One of the main principles which form strategically-important public confidence is transparency of public finance system¹⁸. Based on this principle, systems of education and information technologies developed for stakeholders in the public sector of Ukraine have the function of control over allocation and spending of budgetary funds at all administration levels, down to individual level. The system «Transparent Budget» provides full access to the stakeholders of public finance system of Ukraine.

6.7. Key 7. Create and develop knowledge and excellence Centre

Again, using Virtual University as an example, the main tasks of “knowledge and excellence centre” was to provide training and independent testing of all interested parties on public finance system reload. The knowledge accumulated about the activities of departments, their functions and tasks were presented in the form of creative pattern form and templates

¹⁸ Azarov N.: op.cit.

about the development of technological maturity of the public finance system in Ukraine. To support the centre a large number of textbooks and academic commentaries in the field of public finance were prepared.

In the process of implementation of development programs, there is a non-linear nature of changes (threats, challenges, and risks). They are concentrated in the neighbourhood of bifurcation points. As example, dynamic diagram of threats by “toxic loans in banking sector” of Ukraine is presented in fig. 4. This diagram is built based on the system of external and internal indicators¹⁹.

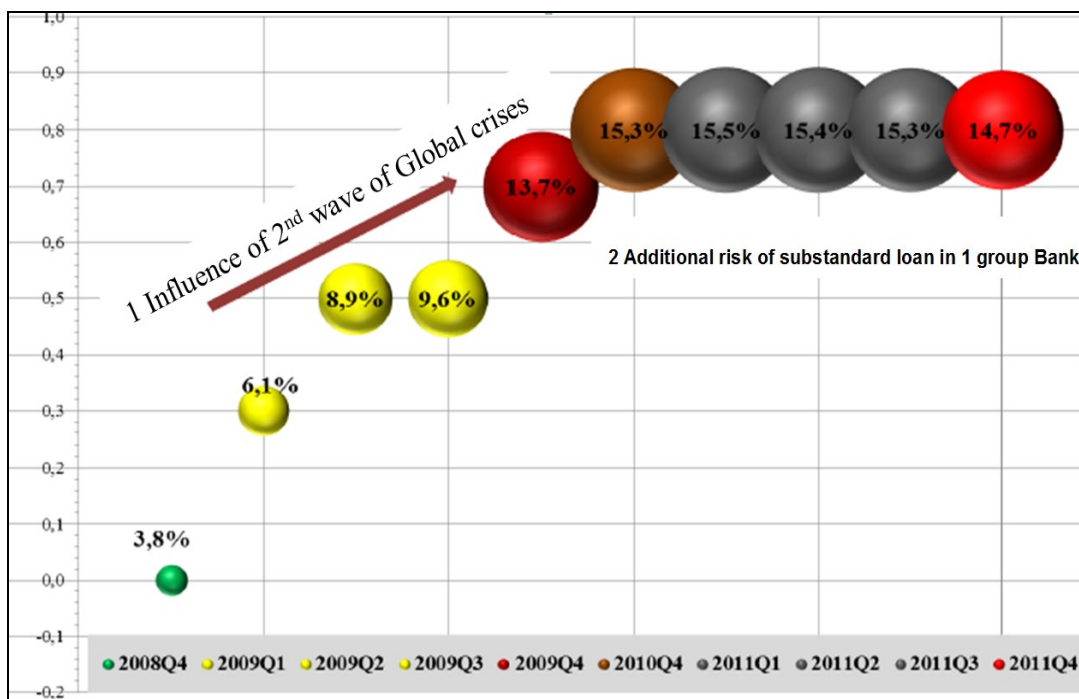


Fig. 4. Bubble diagram of credit threats in the banking loan sector

In fig. 4, a vertical axe is the probability of bubble explosion. Horizontal axe is the time. The sizes of bubbles represent the level of damage to the economy. The colours of bubbles represent the level of turbulence after bubble explosion.

7. Testing threats by alternative management scenarios

Common scenarios of threat management are formed using the following steps.

1. Pareto area is set up and consists of a set of bubbles. Each bubble is characterized by three parameters:

¹⁹ Yaroshenko F., Bushuyev S., Bogdan T.: op.cit.

- a. the probability of the threats materialising (explosion of the bubble),
 - b. size of the damage,
 - c. consequence of the treat actually materializing (a possible chain reaction, turbulence in the environment).
2. Dynamic behaviour of bubbles is considered, including the relationship between them in the current time and a number of scenarios for each bubble until the next bifurcation point (checkpoint). In addition, a set of scenarios is considered – those that would reduce the risk of explosion, the size of damage and consequences.
 3. A model of full immune reaction to Pareto area threat is formed taking into account the interactions between bubbles.

For each scenario the following should be determined:

- the content of each scenario,
- parameters of the endpoint including risk, size and consequence,
- a recurrence scheme of movement in the project to take into account the movement by all bubbles.

8. Immunology of projects

Immunity of human being is the state of immunity to various infectious and generally alien to the human genetic code organisms and substances. The immunity of the organism is determined by the state of human immune system, which is represented by organs and cells. The same thing exists in the field of project management is given below.

The immune system in project management – is a set of components that allows you to successfully implement the project or program within the stipulated time and budget, and protects it by identifying and destroying threats (pathogenic cells and viruses), which are the effect of external and internal environment. The ultimate goal is the destruction of the immune system of a foreign agent. The immune system of project management defined many ways to detect and remove foreign agents. This process is called “immune response”. For example, the suppliers do not meet the conditions of the contract, and as a result did not put the equipment and materials on time and thus put the completion of the project at threat. In this situation, the immune response is a reaction to the manager of this event, namely, the possibility of solving this problem either, as soon as possible, to seek other suppliers or produce freeze the project, or to increase the duration of the project or to withdraw funding. A similar situation can be traced to the contractors and general contractors if they performed work and provided substandard services. Immune response in this case would be increase the quality control. Of the above implies that the immune response in project management is the protection aimed at successful implementation of the project.

The main objective of this model is to develop a strategy for management of external threats based on immune mechanisms. The basis of mechanisms developed by the authors is formed by developing an analogy with the immune mechanisms of living organisms. Immune mechanisms should lead to the immune reaction. As an example, using this analogy, a situation can be considered whereby there is a loss of capital at high-technology enterprise due to the wrong policy being applied and VAT not being refunded to it as a result. In such an instance it would be necessary to compensate these 'missing' funds through redistribution of funds from other activities or through loans. On one project or another affect "strangers agents" or in other words, viruses, thus they are subjected to the immune system of threats for the project. When a virus is detected and evaluated, it is necessary to decide on an adequate response to it.

This is done by among the responses release such as the reduction or preservation, forwarding and participation.

Case A. Reduction. Generally considered the first alternative is to reduce the impact of the threats. Example bridge project is an illustration of the reduction agent. The project of the new bridge for the coastal ports had to use an innovative process of continuous pouring of cement, developed by the Australian company in order to save time and huge cash. The main impact of the virus was the fact that the continuous casting process in each section of the bridge was a really should not be interrupted. Any failure could lead to the fact that the entire section of the cement (hundreds of cubic yards) had to break down and start all over again. In assessing the potential viruses all the attention paid to the delivery of cement from the factory. Cement could stay on the road or the plant could stand. Such threats could lead to huge costs for rework has been done and behind schedule. The threats is reduced by constructing two additional mobile cement plants on different highways just 20 miles from the planned bridge on the case of failure of the main plant supplier. These two additional plants of raw materials enough for a whole section of the bridge, and additional trucks were always ready when needed continuous pouring cement.

Case B. In some cases, are deliberately to preserve the threats. Some threats are so large that they simply cannot or impossible to divert or reduce (for example, an earthquake or a flood). Project owner simply takes it for granted, because the possibility of such infection is very low.

Case C3. Forwarding threats the other side – It is quite normal. Forwarding does not change the value. Redirecting threats other side almost always results in the payment of allowances for it. The contracts with fixed prices are a classic example of the threat of diversion from the owner to the contractor. Contractor understands that his company will pay for any threats that will take place. An easier way to redirect threats is insurance.

Autoimmune reactions – is the disease associated with dysfunction of the human immune system, which begins to take its own tissue as foreign and damaging them. These diseases are called systemic, because, as a rule, the whole system is affected, or even the entire body.

In our time, often speak of new infections, which are a threat to all humanity. This is, first and foremost, AIDS and SARS (SARS), avian influenza and other threats diseases.

A main feature is by analogy with the human body, there are an autoimmune reaction in project management – a disorder that are characterized by the destruction of the whole system as a consequence of the existence of threats in the middle of the project, which leads to failure and thus do not allow to realize the project in full. An example of such an autoimmune reaction to acts of corruption in the project. Corruption – a term denoting usually use their official powers and rights entrusted to it, as well as the associated status of official authority, opportunities, contacts for private gain, contrary to the laws and moral precepts. Corruption may be subject to any official having authority in the field of distribution of any not owned by him at his discretion resources. The main incentive for corruption is the possibility of obtaining economic benefits associated with the use of power, and the main deterrent – the risk of exposure and punishment. There are three possible approaches to reduce corruption.

Firstly, it is possible to tighten the laws and their implementation, thereby increasing the threat of punishment. Second, you can create the economic mechanisms that allow officials to increase their income without violating the rules and laws. Thirdly, it is possible to enhance the role of markets and competition, thereby reducing the size of potential profit from corruption. It also provides the latest competition in the provision of public services, provided that duplication among government agencies of other organs.

Another difficulty, especially when manifested by large-scale corruption, when most individuals give bribes, known in psychology and game theory as a "prisoner's dilemma". On the one hand, if all people stop giving bribes, they will all benefit from it. However, if only one individual refuses bribes, it will put itself in an extremely unfavourable condition.

The immune response can be developed through multi-level antibodies and such response is accompanied by changes.

When entering the market with a product which has an exhausted life cycle (delay of 7-10 years), the project may become unsuccessful and the best outcome of such project may be its earliest termination with minimal losses of resources.

The key parts of immune mechanism are:

1. Diagnosis of critical threats that belong to Pareto area.
2. Testing of alternative threat management scenarios (individual threats management scenario is tested first followed by being tested as part of a complex).
3. A unit of a full immune reaction formation to the Pareto area threat taking into account their interactions.

In our research have been considered definitions and examples of project management immune systems. From the above we can draw the following requirements:

- integrity, that is a sufficient degree of consistency with the environment created the project has been agreed with the environment, with which it will operate, would be included in this environment not as a foreign element, but as a natural part;
- easy project management mechanism;
- adequacy of the immune system of project management. The adequacy of the system means that you can use it to achieve its objectives of the project in accordance with the laid down criteria. The adequacy of the system means that it is sufficiently complete, accurate and true. Enough is not general, but to the extent that allows you to achieve this goal.

9. Conclusions

From the analyses presented the following can be presented:

- application of threats management principles to managing successful development programs based on the conceptual model "uncertainty-threats-risk" give us an opportunity to create holistically view on the threats through program life cycle. This novel idea, a work in progress with grate potential to become a new and useful way of approaching uncertainty and risk in projects;
- a systemic approach to the definition of threats in high technology production project management allows to make conclusions on feasibility and relevance of using "immune mechanisms" in making decisions;
- formation of immune mechanisms within project management methodologies based on the analogy approaches can only occur after the steps of convergence and integration of threats and challenges in development programs of high technology enterprises.
- use of methods for determining the degree of similarity between systems allows to choose a model of immune mechanism and justify the relevance and feasibility of using analogy approaches for the formation of effective project management methodologies.

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