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Modeling the Application of Anti-Crisis Management Business Introduction for the Engineering Sector of the Economy

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ABSTRACT

The main purpose of the article is to model the main stages of the implementation of anti-crisis management in an engineering enterprise that has a crisis situation. The object of the study is the system of anti-crisis management and business in the engineering sector of the economy. The research methodology involves the use of modern modeling methods that contribute to the achievement of the goals. In particular, the basis is the technique of modeling control processes using functional-graphic elements. As a result, we have chosen a concretely operating engineering enterprise that has crisis signs of development and requires the use of an anti-crisis enterprise. The elements of novelty of the obtained results of the study are presented in the form of established models for overcoming a crisis situation due to the use of anti-crisis management measures. The study is limited by targeting only one engineering enterprise. In the future, it's need to expand the scope of the study in future research work, so that the results can be more generally applicable. Further research needs to expand the application of the methodological approach.

1. INTRODUCTION

The modern economy, its nature and development trends, antagonism and contradictions, and, in particular, destructive shifts in the economy, instability of the environment parameters, tears that accompany the emergence of crisis phenomena, the extreme exacerbation of contradictions in socio-economic systems, one of which is of them, one of the engineering enterprise. This requires a revision of stereotypes of managerial thinking and the transition to new forms and methods of the management system compared to those that were developed within the framework of a stable economy. At the same time, the ongoing processes of differentiation and integration of structures, methods and other elements of production management systems also encourage control changes.

The economic activity of any engineering enterprise can be considered economically safe, in which there are no significant threats for its stable and effective functioning, as well as a crisis characterized by impaired state, loss and lack of resources necessary for the development of the market. The current conditions for the distribution of the Covid-19 and its strains caused the last option for the development of many engineering enterprises. According to the events since the beginning of 2020 related to the spread of the Covid-19 coronaviral infection, most engineering enterprises suffered significant losses, some were on the verge of bankruptcy, some small and medium-sized enterprises were forced to stop their activities and stop existence because they were not ready for such scenario of their activities. One of the main reasons for this crisis situation was the inaccessibility of produced goods and services for consumers remotely, as well as their lack of need during self -isolation. Anti-Crisis management is one of the important issues of engineering enterprise management. Since crisis situations can arise in the work of any engineering enterprise, it is necessary to calculate the risks of their occurrence and consider the real plan of action to restore activity.

Enterprises that advanced further on the path of digital transformation in the Covid-19 adapted to the crisis better than others. Their business and working business processes were able to flexibly accept and respond flexibly to the changes that are taking place. Enterprises that do not have a reliable digital network or presence on the network are faced with difficulties. If the company has not yet begun digital transformation, it will be difficult for it to save his business after the pandemic. In our opinion, business structures will launch the digitalization process, even if they now consider digital transformation of a fashion trend, they will soon understand that this process is inevitable. Most engineering enterprises attract investments and new developments in their business, develop E - Commerce.

The anti-crisis management of engineering enterprises should not be focused not so much on overcoming an existing crisis, but, first of all, on identifying its symptoms at an early stage and the prevention of crisis phenomena, which can only be achieved with a sufficient level of competitiveness and competitiveness and economic stability. In addition, the crisis

in the company is a complex and multifaceted phenomenon, and its exit requires not only the elimination of certain risks and threats, but also the transformation of the entire organizational and economic mechanism of the company. That is, anti -crisis management should be focused on increasing the level of competitiveness and economic security of an engineering enterprise.

An engineering enterprise is an activity for the provision of services or the performance of work, since in the production of engineering activities, not only the end result is important to the customer, but also the process itself. The subjects of the provision of engineering services are specialized firms, as well as construction and industrial companies (moreover, there is both a specialization of engineering companies, firms in the provision of such services, and the creation of large industrial construction companies that can provide almost the entire list of relevant services). As for the documented legal support of engineering, its basic source is the contract (agreement) for the purchase and sale of engineering services, which regulates: the volume, quality and timing of the work, with the possible specification of the specific timing of the conduct and performance of individual operations; the composition of the engineering personnel working at the facility, with clarification of the conditions of their residence, stay at the facility; terms of subcontracting, training and retraining of personnel; traditional technical parameters - conditions of validity and termination of the contract; the responsibility of the parties.

Digital transformation is the introduction of modern technologies into the business processes of enterprise engineering. This approach implies not only the installation of modern equipment or software, but also fundamental changes in management approaches, corporate culture, and external communications. As a result, the productivity of each employee and the level of customer satisfaction increase, and the company gains a reputation as a progressive and modern organization.

Economic security of an engineering enterprise is the protection of the vital interests of an enterprise from internal and external threats, the organization of which is carried out by the administration and the staff of the enterprise through the implementation of a system of measures of a legal, economic, organizational, engineering, technical and socio-psychological nature.

Today, one of the challenges is the digital literacy of staff, their ability to master modern technologies for the provision of engineering services. Not infrequently, professionalism and critical thinking are a problematic issue when a contract for large sums is pawned. There is always a risk of its failure and the development of crisis situations. There is a problem with the marketing strategy, internal conflicts, shortcomings in the organization of production, imperfection of management, innovation and investment policy becomes a challenge for the management system.

The main purpose of the article is to model the main stages of the implementation of anti-crisis management in an engineering enterprise that has a crisis situation.

The structure of the article implies an analysis of the literature, a description of the research methodology, a presentation of the main results of the study, a discussion and comparison of the results obtained, a description of the conclusions drawn.

2. LITERATURE REVIEW

As noted by most scientists in the literature [1-3], engineering enterprise belongs to the class of complex socio-economic systems, characterized by increased complexity of relationships both at the internal and external levels of building the interaction of its constituent elements and participants. Engineering enterprise as a socio-economic system is characterized by the presence of a person in the aggregate of interrelated parts. The set of solutions in the socio-economic subsystem is characterized by great dynamism both in quantity and in the means and methods of implementation. This is explained both by different professional abilities, skills and abilities, and by the excellent psychological reactions of people to situations of the same type. It is difficult to disagree with this, and we also share a similar scientific opinion about the essence of engineering enterprise.

The economic development of the engineering enterprises, due to global changes and the emergence of new business circumstances, formed under the pressure of a competitive environment, is impossible without the creation of competitive production. The implementation of tactical and strategic decisions for such production is impossible beyond a high level of organization of production processes, timely response to factors influencing the volume of production of engineering products [4, 5].

The crisis in the activity of economic systems constantly aroused the interest of scientists from different countries [6, 7], but it was studied, most often, at the macro level. Until recently, on the part of scientists, at the level of a separate engineering enterprise, this issue was not studied deeply enough, which in turn led to the fact that the heads of engineering enterprises and managers could not effectively influence the development of crisis phenomena, make the crisis more manageable. But in recent years, the aggravation of macroeconomic instability, even in countries with a developed market economy, traditionally stable, has significantly worsened the conditions for the functioning and development of all business entities and led to an increase in the uncertainty of the external environment. In connection with these events, the interest of scientists in crisis phenomena has significantly increased, namely, attention has become more acute to the study of crises at the micro level, their influence and consequences on the functioning and development of engineering enterprises.

The response to the development of a crisis situation occurs due to the methods used for diagnosing and predicting crisis phenomena, which can play both a preventive role and help reduce losses in the activity of engineering enterprise by developing measures to minimize the risks of a crisis situation unfolding in an unfavorable direction for engineering enterprise [8, 9].

In the literature specializing in anti-crisis management [10, 11], it is noted that the anti-crisis foundations in the management of engineering enterprise are a set of methods and methods aimed at preventing the occurrence or minimizing the negative consequences of crisis phenomena and processes in activities as a result of surprises and do not allow to achieve the planned strategic goals, weaken the competitiveness of its strategic potential and, as a result, competitive positions in the market. Solving the problem of anti-crisis management to prevent a crisis implies a comprehensive, systematic and strategic approach to the analysis and solution of emerging

problems and has common features for many engineering companies.

However, according to the results of the analysis of scientific and practical literature, the search for new approaches to the formation and implementation of an anti-crisis management system for the engineering enterprise, already in its current state, which is in crisis development, remains relevant.

3. METHODOLOGY

The basis of the methodology of our research is the modern technique of functional-graphic modeling of the anti-crisis management process.

Some experts believe that the IDEF0 standard is outdated. In our opinion, this is not so. IDEF0 continues to be one of the most convenient standards for describing any management processes, including anti-crisis ones at the top level.

The main object of the process diagram in the IDEF0 notation is an object defined as desirable in achieving (in our case, this is a counteraction to crisis phenomena in the engineering enterprise). Graphically, it is a quadrilateral. The object is used to describe the functions (stages, sub-processes) performed in the organization. Recall that any function (procedure, work) can be considered as a certain process. At the top level, each management process can be represented as a "black box" that turns inputs into outputs (desirable socio-economic effect).

The second main component of the IDEF0 standard is the links represented by arrows. All arrows start from the edge of the diagram and go to the functions. Thus, the edge of the IDEF0 diagram has a deep meaning.

Process modeling in IDEF0 notation begins with the creation of a so-called context diagram. This diagram defines the activities of the organization or the crisis management process as a whole. The context diagram displays the most important inputs and outputs, the mechanisms necessary for work, managing influence.

The most important requirements of the notation are the number of objects in the diagram and the number of arrows included in each side of the quadrilateral. The standard recommends placing no more than six and at least two functions in one diagram. On each side of the quadrilateral, no more than six arrows can enter at the same time. Both of these requirements limit the number of objects in the diagram and force the analyst to think more carefully about the scheme of the process being created.

Each object (function, work) in the IDEF0 notation process diagram can be numbered. Thus, the IDEF0 frame is a convenient standard tool for specifying the main characteristics of an engineering enterprise management process diagram.

The IDEF0 business process modeling methodology, in our opinion, is intended to describe top-level processes. Describing such processes, the person pays great attention to anti-crisis process management, feedback to management and information.

The practical process of applying the chosen modeling method involves the formation of the goal, then the definition of the means to achieve it, then the definition of the processes for achieving it. All this goes through the appropriate vector program and simulation in such a way as to be understandable in a graphical way.

IDEF0 has a number of advantages, among which is its simplicity and convenience delivered through a graphical modeling language. A separate factor is flexibility and adjustment depending on the progress of a particular stage.

The arrows represent the influence and the direction where to go next. In this context, the practical value of IDEF0 should be discussed. It lies in the fact that crisis management performs a number of functions, including planning and control. It is in the practice of the planning and control phase that the IDEF0 model will be valuable.

It should be explained that the context diagram is an important step in process modeling, and how this step ensures the accuracy and efficiency of the overall process of the system.

There are a limited number of objects. It is important to limit the number of diagram objects and wires, which helps to prevent the process design from spreading endlessly and thus complicating project management.

It should be noted that modeling the implementation of anti-crisis management cannot be correct if the engineering enterprise is chosen without crisis situations. That is why, for a clear example of the application of our methodological approach, we have chosen the engineering company Servipol, which operates throughout central Europe, but today is experiencing problems with managing crisis situations that have arisen and need to be addressed step by step.

4. RESEARCH RESULTS

To begin with, it is necessary to determine the purpose of modeling and the stages of its achievement. We will divide this process into two parts. Let's designate the first part as achievements A0 "Prerequisites for ensuring anti-crisis management" and the stages accompanying its achievement (Figure 1).

But besides this, it is necessary to carry out the very implementation of anti-crisis management at the engineering company we have chosen (engineering company Servipol). We will designate this goal as B0 "Implementation of anti-crisis management" (Figure 2).

It is necessary to describe in detail each stage of achieving A0 "Prerequisites for ensuring anti-crisis management":

A1. Formation of the technological scheme of anti-crisis management. The technological scheme of anti-crisis management of an engineering enterprise may include the following steps: 1. Formation of a group of professionals whose task will be, if they have the necessary capabilities and resources, to bring the engineering enterprise out of a crisis state. 2. Establishing the feasibility of carrying out measures for anti-crisis management of engineering enterprise. 3. Development of management decisions to bring the engineering enterprise out of a crisis state. 4. Creation of a system for the implementation of management decisions. 5. The process of implementing management decisions in the areas of exit from the production and technological, marketing, financial, organizational or personnel management crisis, systemic crisis of the engineering enterprise. 6. Checking the quality of implementation of management decisions. 7. Checking the feasibility of carrying out further work to bring the engineering enterprise out of a crisis state. 8. Development of measures to predict future crisis situations.

A2. Formation of a risk management system. The risk management system of an enterprise at the stage of its

implementation in order to reduce or avoid their negative impact involves the use of the following risk management methods: risk avoidance (rejection of unreliable partners, rejection of innovative projects, business insurance, creation of regional or sectoral structures of mutual insurance and systems reinsurance); risk localization (allocation of "economically dangerous" sites into structurally or financially independent units, formation of enterprises, consistent downscaling of an enterprise); dispersion (integration distribution of responsibility between production partners, diversification of activities, sales markets, expansion of purchases of raw materials, distribution of risk by stages of work); compensation and such basic methods as avoidance, retention, transfer, reduction (implementation of strategic planning, forecasting (economic forecasting is a scientific and practical activity aimed at determining the trends in the economic development of an object, assessing its possible states in the future and searching for alternative ways and timing for achieving them) the external economic situation in the country, region, monitoring the socio-economic and regulatory environment, creating a system of reserves for engineering enterprise, active targeted marketing).

A3. Formation of a system of anti-crisis regulation. Anti-crisis regulation can be considered both at the macro and meso levels, and at the micro level, but in the aggregate. At the same time, the content of anti-crisis regulation as a macroeconomic category is seen in the measures of state organizational, economic and regulatory action on enterprises and industries at the stages of prevention, response and study of crises, while anti-crisis management at the micro level can be defined as a system of measures to influence socio-economic relations, emerging at the level of engineering enterprise when preventing a crisis, responding to it and studying its consequences.

At the same time, all these stages should somehow be systematized through the modeling method. By themselves, they cannot be effectively produced at an engineering enterprise. There are a number of elements that allow or vice versa will negatively affect their implementation. However, there will be a certain result at the output. This result is represented by a diagram (Figure 3).

Thus, as the main result of the study, we built a decomposition vision of the main model for achieving the set goal A0 for engineering enterprise (Figure 4).

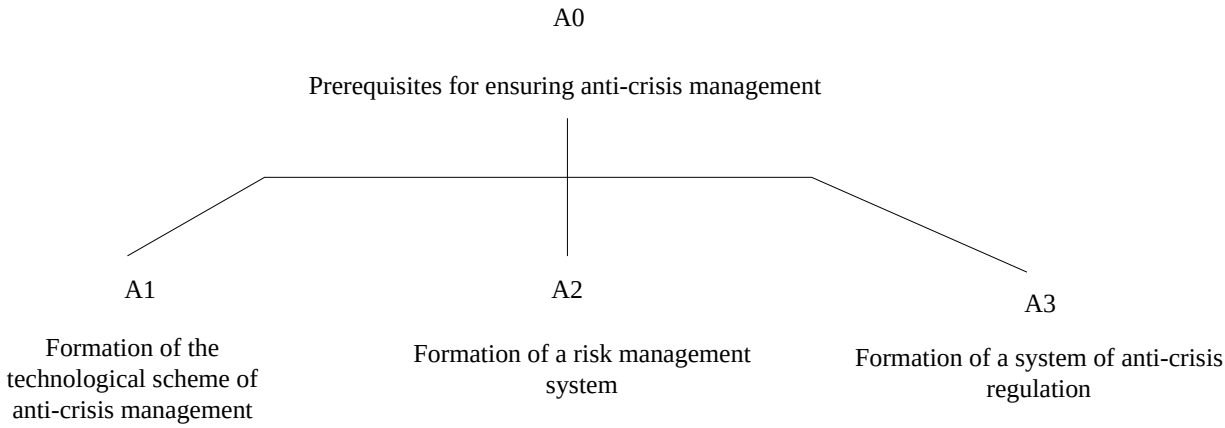

Figure 1. Stages of achieving A0 "Prerequisites for ensuring anti-crisis management"
Formed by authors

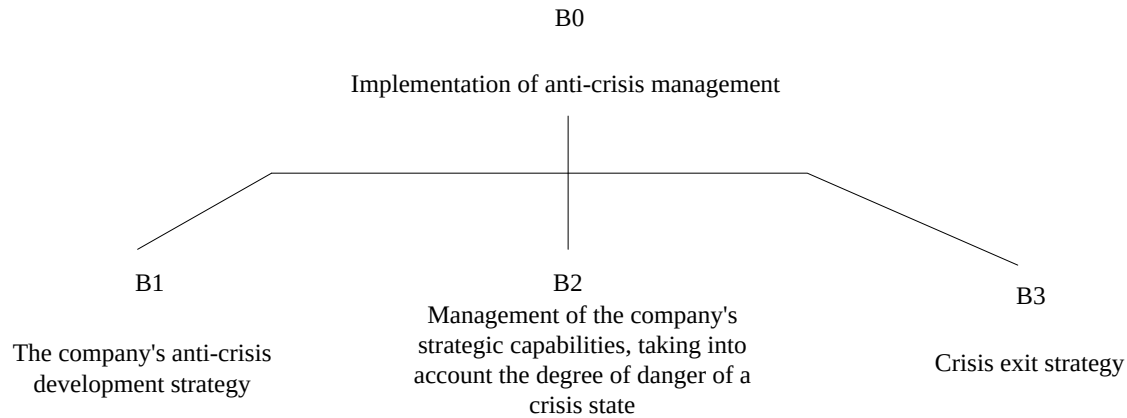

Figure 2. Stages of achieving B0 "Implementation of anti-crisis management"
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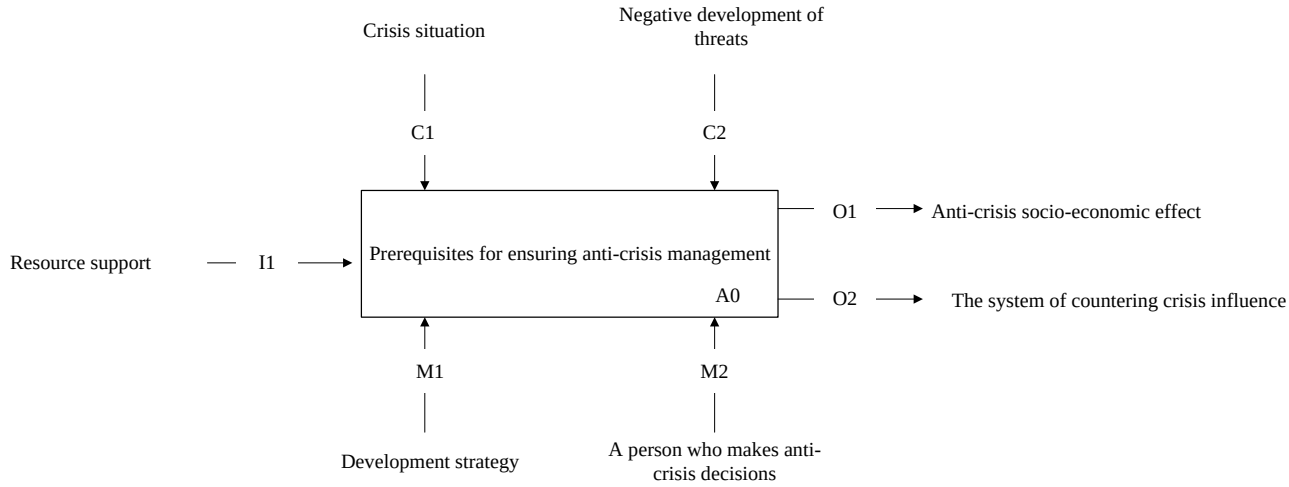

Figure 3. Diagram of the context of achievement A0 "Prerequisites for ensuring anti-crisis management"
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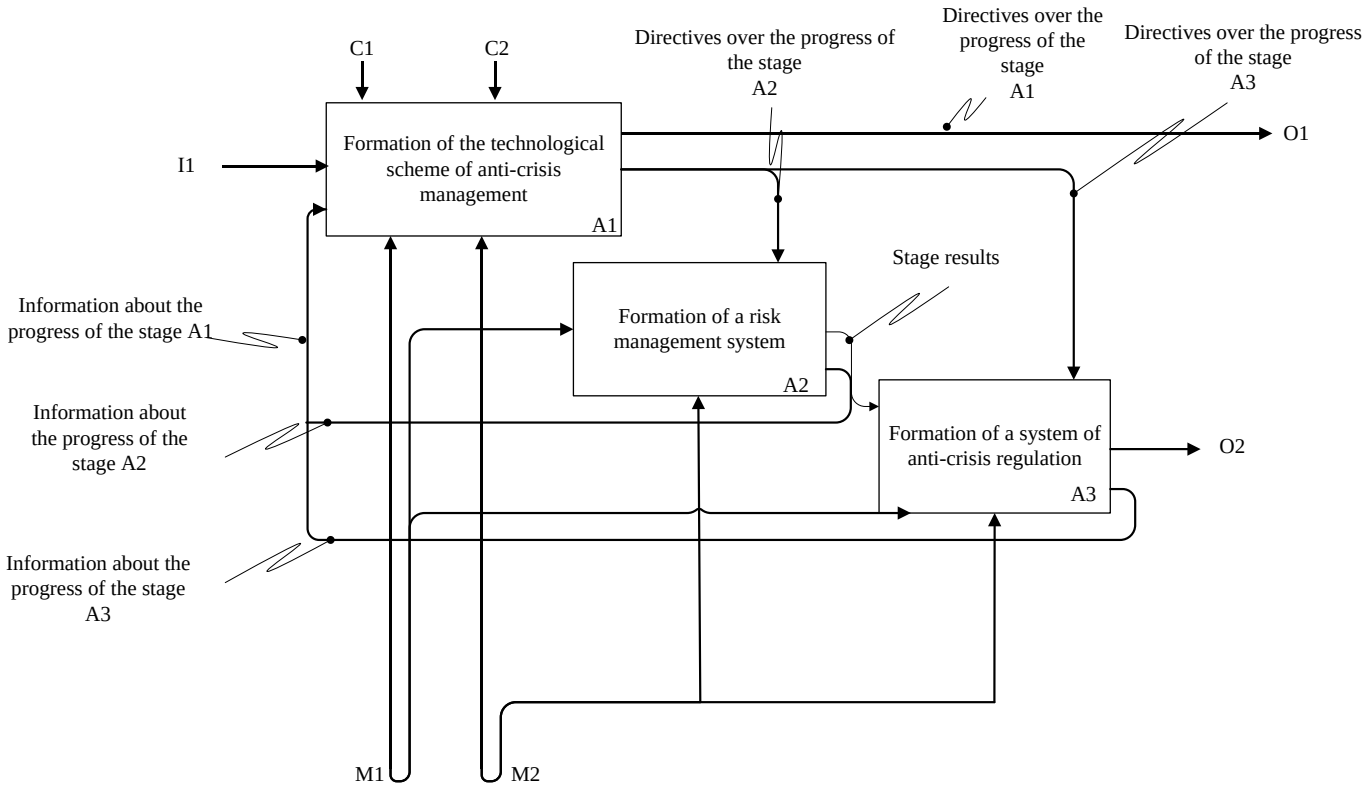

Figure 4. Decomposition vision of the main model for achieving the set goal A0 " Prerequisites for ensuring anti-crisis management "
Formed by authors

Each stage of achievement B0 "Implementation of anti-crisis management" should be described in detail:

B1. The company's anti-crisis development strategy. The development strategy of enterprise engineering, taking into account the degree of threat of a crisis state, should have a number of inherent features: the process of its development ends with the formation of general directions that can ensure the growth of strategic capabilities and competitiveness of engineering enterprise; for it, it is essential to strengthen the feedback, which allows you to search for the most reasonable solutions from a variety of new alternatives due to the diagnosis of strategic opportunities and adjust the previously formulated strategic development goals; such a strategy is inherent in certainty, which is associated with the possibility of predicting the development paths of engineering enterprise. The ultimate goal of such a strategy is to ensure the achievement of unique strategic opportunities that are ahead of the development of the processes of other companies and effectively counteract the emergence of crises.

B2. Management of the company's strategic capabilities, taking into account the degree of danger of a crisis state. The modern direction of management, the main task of which is the definition and implementation of strategic anti-crisis measures in the face of limited strategic opportunities,

engineering enterprise based on the results of identifying the degree of manifestation of a crisis state and a reasonable choice of a development strategy in order to achieve the required level of its effectiveness, as well as improve the use of strategic opportunities and preserve a sufficient level of profitability of the engineering enterprise. The maximum effectiveness of the implementation of such management is achieved when there is a change in attitude towards people, technology and innovation, the knowledge system.

B3. Crisis exit strategy. The engineering strategy of an enterprise in a crisis state is a comprehensive plan for exiting an engineering enterprise from a crisis state, and an aggressive anti-crisis management strategy is an anti-crisis policy developed on the basis of foreseeing the future development, nature and consequences of production and economic activities by determining and predicting results, necessary resources, means and methods of management based on economic diagnostics in order to cause maximum damage to competitors for their own benefit (increasing profitability).

Similarly, in the case of achieving A0, a number of elements will act and influence the achievement of B0, since we have the same socio-economic system through engineering enterprise (Figure 5).

As in the case of A0, the achievement of the second goal (B0) should also provide for the construction of a decomposition vision of the main model for achieving the set goal B0 for engineering enterprise (Figure 6).

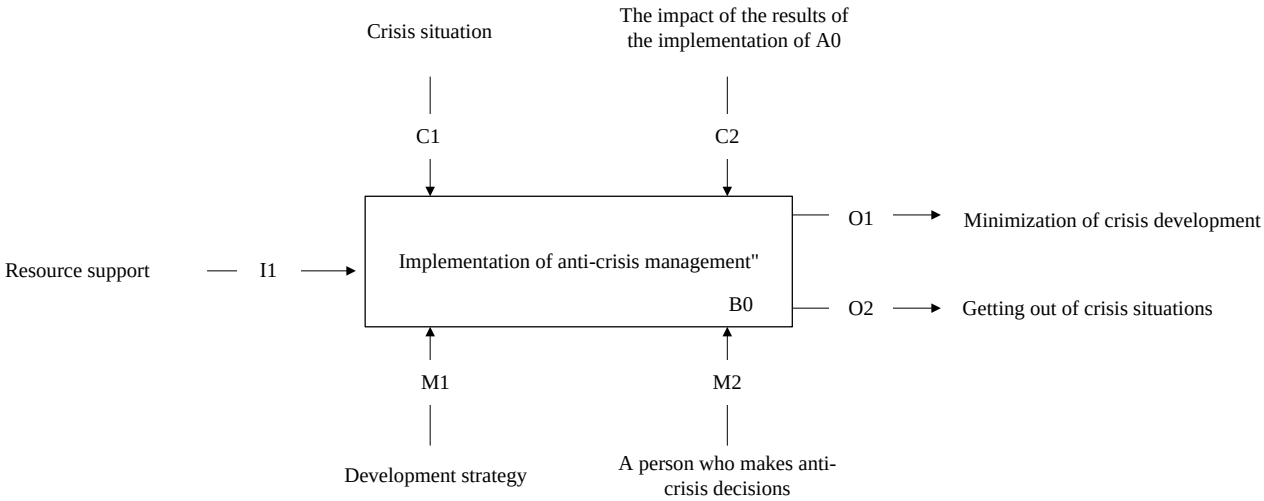

Figure 5. Diagram of the context of achievement B0 "Implementation of anti-crisis management"
Formed by authors

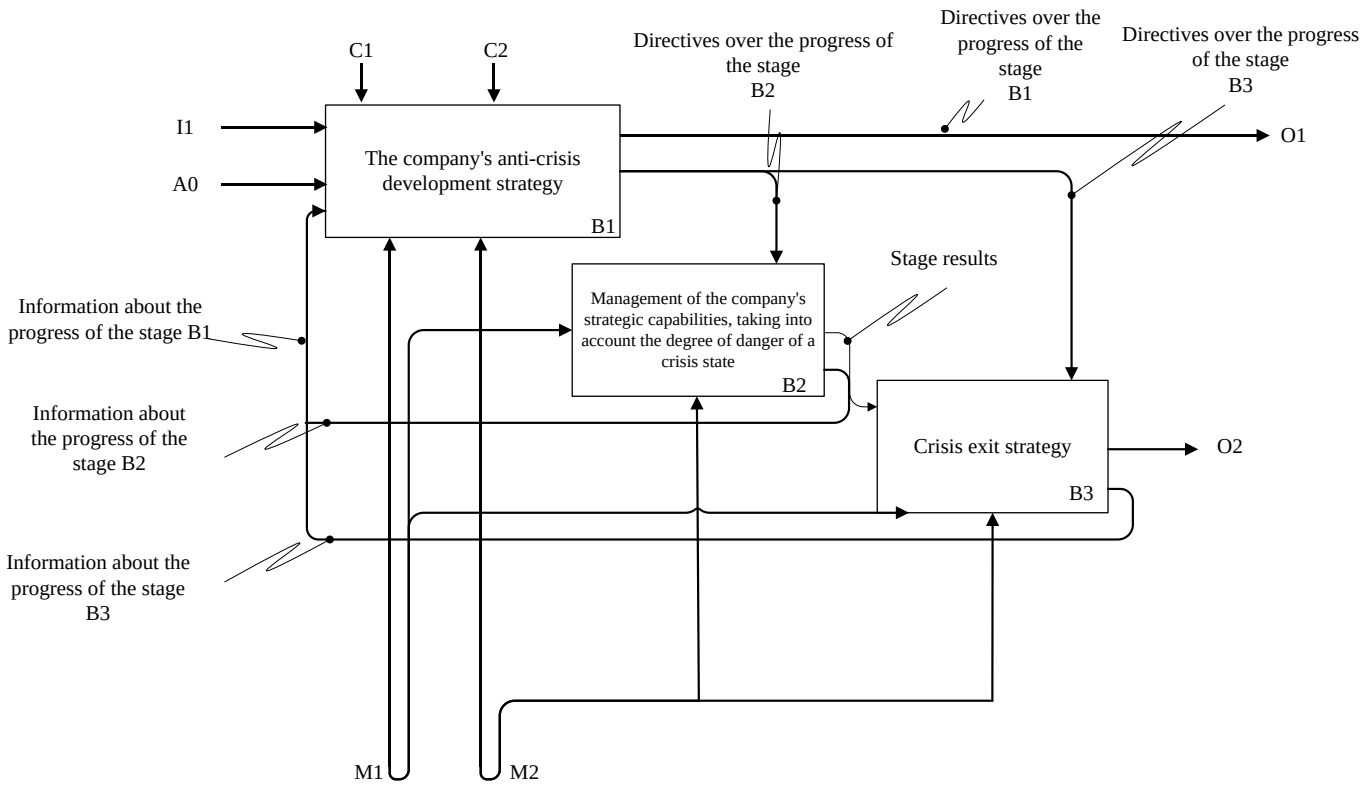

Figure 6. Decomposition vision of the main model for achieving the set goal B0 "Implementation of anti-crisis management"
Formed by authors

In general, we have formed two functional-graphic models for the engineering enterprise ", the stages of which take into account the specifics of the activity of the socio-economic system we have chosen.

5. DISCUSSIONS

When discussing the results of our study, we should compare them with similar ones in the field. So, some scientists focused on the system of anti-crisis personnel management of the engineering enterprise [12, 13]. The system of anti-crisis personnel management is a set of subsystems of general and line management, a number of functional subsystems that specialize in performing homogeneous functions and relationships between them, the purpose of which is to provide conditions for the development of human potential to prevent the occurrence of crises and conditions. However, our study did not make such an emphasis. In addition, we did not try to form a whole separate system.

Anti-crisis personnel management is a set of purposeful actions of the enterprise management for social protection, creation of appropriate conditions for the effective use and development of the personnel potential of a crisis enterprise.

The use of non-extrapolation methods (Extrapolation is a method of scientific research, which consists in extending the conclusions obtained from observations of one part of a phenomenon to another part of it. In a narrow sense, this is the definition of a function of its other values outside this series from a data series) for forecasting the development of technologies, structural economic forecasting, and scenarios is becoming more widespread. Such forecasts provide information on the basis of which it is possible to take measures for the onset of negative events. The period for which forecasting is carried out is long enough, which allows to complete the corresponding actions before adverse events have time to cause tangible damage. This type of management is called planned. According to him, an appropriate response should begin immediately, as soon as the forecast for sure indicates the emergence of a threat. Delayed response in the system with planned management is minimal [14-16]. However, forecasting was not the focus of our study, but modeling.

Some similar studies in the field of development of the engineering sector of the economy focus on the tasks of anti-crisis management [17-20]. The main task of anti-crisis management most often is the development and implementation of the least risky management decisions that would achieve the goal and result with a minimum of additional funds and with minimal negative consequences. While the main task of anti-crisis management in the context of a growing crisis is to learn not to counteract crisis phenomena, but to use them for your own benefit: to choose the strongest side of engineering enterprise, identified thanks to the diagnostics, and in this direction to harm competitors, while choosing any management technologies. However, the main difference between the results obtained by us lies in the emphasis on the stages of implementation of anti-crisis management engineering enterprise, which has already found itself in a crisis situation.

The innovativeness of the obtained results lies in the use of a methodical approach to solving the problems of anti-crisis management by modeling in a graphical language for better planning and control over this process.

6. CONCLUSIONS

Summing up, it should be noted that increasing the efficiency and effectiveness of managing the engineering of enterprises, the flexibility and mobility of their functioning is an extremely urgent scientific task, the solution of which will provide a significant national effect. Although anti-crisis management may be part of an overall management system, they are conceptually opposed to each other; Therefore, the role of anti-crisis management as a management approach lies in the premature prevention of crisis costs, which may seem unreasonable, while in fact they should be minimized by preventive measures (less costly than post-crisis measures).

Against the background of economic, political, financial instability, imperfection of the market for goods and services, the investment system, a significant number of bankruptcies, engineering enterprises are characterized by an increase in interest in the problems of studying crisis phenomena, the nature of their occurrence, the factors that cause it, the mechanisms for preventing and eliminating consequences. In such cases, it is the method of anti-crisis management that will come in handy.

Therefore, in order to assess the impact of crisis phenomena on an enterprise, one should understand not only their causes, but also their possible consequences. They can be both the destruction of the engineering enterprise, and its renewal, both the recovery of the company, and the emergence of a new round of crisis in it. To prevent these processes from adversely affecting the organization, crisis management is used as a management process, which allows managers to carry out their functions in a way that optimally eliminates urgent problems. Consequently, anti-crisis management of an enterprise as a system is a set of measures of a strategic direction that help eliminate the problems that arise in its activities.

As a result, we have chosen a concretely operating engineering enterprise that has crisis signs of development and requires the use of an anti-crisis enterprise. The elements of novelty of the obtained results of the study are presented in the form of established models for overcoming a crisis situation due to the use of anti-crisis management measures. The study is limited by targeting only one engineering enterprise. This can be a strategic approach to considering anti-crisis management by engineering of enterprise. A multi-purpose strategy as a universal tool for anti-crisis management of engineering of enterprise should have the following advantages: implement the principle of independence; foresee the use of crisis opportunities in development; anti-crisis properties are instilled in the organizational and economic system; produce adaptive properties; maintain a high speed of movement in an aggressive environment; create the possibility of organizing a synergistic invasion of the industry through several nodes of the value chain; minimize risks; ensure access to the maximum depth of diversification and the ability to work in conditions of limited mobilization resources.

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