

FEATURES OF THE ENTERPRISE DEVELOPMENT MANAGEMENT DURING THE CRISIS

National Aviation University
Kosmonavta Komarova avenue 1, 03680, Kyiv, Ukraine
E-mail: nat_kas@ukr.net

Abstract. *In the article the key moments in the development of the economic system were described, the problem of determining bifurcation points was solved and, on this basis the trajectory of the enterprise was chosen. The essence and characteristics of enterprise development management during the crisis was overviewed. A choice of methodological support development strategy was made based on a study of possible trajectories. Practical aspects of business management in the proposed methodologies were scientifically reasoned.*

Keywords: attractor; bifurcation point; crisis; enterprise; dynamic system; the trajectory of development.

The development of industrial enterprise is characterized by a close relationship between the phenomena of stability and uncertainty, so any economic system is only partially dynamically stable. The development although it is continuous in nature, contains the likelihood of crises, causing state instability. Violation of relative stability is not only because of the accumulation of quantitative and qualitative changes in the elements of the system, but also in the relationships between them. Considering the combined effect of these factors makes it possible to formulate a strategy for the development of the economic system.

Implementation of development strategy requires the development of appropriate theoretical background and practical tools for diagnosis of the enterprise, assess existing capacity development, training and economic examination of individual measures, assessment of their consequences, the formation of enterprise development programs and the monitoring of its implementation. Necessity of the accumulated system's potential and the implementation of focused push at the time of the bifurcation, is a ground of the relevance of this study.

Changes in the economy are universal in nature, and research issues of evolutionary processes and bifurcation devoted a significant amount of scientific literature. Brussels School of Prigogine develop the theory of dissipative structures [1] H. Haken School explores the processes of self-organization in various systems [2], catastrophe theory, which studies abrupt changes developing in the V. Arnold, T. Poston, I. Stewart [3, 4]. Categories and concepts of the theory of self-organizing systems are the subject of a wider

philosophical and scientific thinking. Review of the literature clearly shows that the current understanding of the synergy still not received systematic adequate interpretation to create meaningful evolutionary patterns and processes of bifurcation in the economy. The most unexamined task is to identify the key points of the economic system of any level.

The aim of this work is to study the presence of the key moments in the development of the economic system, solving the problem of the definition of bifurcation points and choice on this basis, the trajectory of the enterprise.

Each company develops according to certain laws, regardless of its causes. The life cycle of the company reflects its evolution from concept to the disappearance of the company as a separate entity. Elements of the company depend on a combination of the external factors and internal environment. Economic environment is formed in the demand factors, technological news and structural market conditions. The company, which approached the limits of its existence, is revived by means of transformation of its structures, technologies, personnel replacement or replenishment and needs to change the whole strategy. Thus the "new company" is born and resumed its life cycle. However, this conclusion is possible at a qualitatively different approach to the theory of enterprise development, based on a combination of cumulative and synergistic approach to the economic system.

Forecast of the critical changes in large non-linear systems can be based on the fact that at a certain instability level there can be expected large-

scale anomalies in system behavior at a smaller scale. One of the components of the proposed concept is regular analysis of anomalies using temporal time series 10-15 (activation behavior and deviations from the trend, volatility clustering acts, etc.) that describe the main aspects of the enterprise. This analysis serves as a basis for determining the major episodes of destabilization of the company.

For detection of bifurcation points and ranking there exists a broad list of possible events that can be viewed as critical, after which the scanning of the temporal series use different statistical methods to find points of the company's behavior change.

Problem of the company diagnosis bifurcation points is associated with the production task of determining the form and extent of volatility through simulation processes of destabilization.

Possibility of critical phenomena in the enterprise poses some fundamental questions:

- If the structure of the company allows such phenomena,
- In which elements (fields) can crisis happen
- When it happens; is it possible to assess the time of crisis,
- What, in the structure of the company, defines the emergence of the crisis,
- How to change the structure of the company or how it should be controlled

These issues are expressed in different terms, and are successfully solved in the theory of nonlinear parabolic equations. Parabolic equations form the basis of mathematical models that describe the evolution of various processes in physical, chemical, biological, socio-economic and other systems. Mathematical models built for the study of specific practical problems are often very complex. Despite the fact that evolutionary processes in different environments have different nature, they are described rather narrow set of equations or systems of equations. Among these models particularly for quasi-linear parabolic equation. Being outwardly simple, these equations are quite substantial:

$$B(u) = u(t, x) - \nabla(k(u)\nabla u) - Q(u) = 0,$$

$$x \in \Omega \subset R^N, t > 0$$

where $u(t, x) \geq 0$ – system's rating (controlled parameter);

$t \geq 0$ – time;

$x \in N$ – spatial dimensional coordinate;

$N \geq 1$ – space dimension;

$k(u) \geq 0$ – coefficient of influence of control parameters;

$Q(u)$ – factors that influence system ($Q(u) \leq 0$);

Ω – spatial region in which processes are considered.

The coefficients $k(u)$ and $Q(u)$ are defined in general nonlinear functions $u(t, x)$. If they are both linear, the equation does not generate critical points. We can say that the functions $k(u)$ and $Q(u)$ is the "parameters" of the system. The structure of equation can be more complex. For example, the coefficients may depend on the spatial variable x (a system with distributed parameters).

There can be offered a scheme of the theory of non-stationary processes to industrial research:

1. In the first stage the most common process model should be created: to describe all elements of the enterprise, the connections between them, consider external sources of action and so on. This is a rather complex process that requires a large and reliable information on the structure of the company.

2. Next goes the formalized description of the company, that is a mathematical model. As originally studied the evolution of the company (their development over time), there is reason to believe that as an adequate model can be effectively used as a nonlinear parabolic equation.

3. Putting an appropriate task for sufficiently simple mathematical model, that should be examined analytically. An important stage of this study is to find the exact solutions of the problem, which, combined with advanced technology making comparisons of the same equation can show the characteristics of arbitrary decisions. At this stage, we can conclude the existence of critical points and the nature of their evolution: time to assess the crisis and to explore the possibility of an effective and strict localization.

The objects of research are industrial enterprises, systems, which have a management function (conscious, purposeful activity) and whose main elements are the workers. Therefore, any company should be considered as a socio-economic system, as the most important relationships in their favor are social and economic.

Considering the company, that is assumed to be a dynamic system, a system that changes over time. This generally nonlinear systems with nonlinear interactions and nonlinear laws of development for which it is advisable to use the term path of development".

Occurring changes in the enterprise, accumulate, resulting in the company losing stability and moving to a different trajectory and further developed within

other stability. Based on the external and internal conditions, specific system can take several classes of bifurcation, which eventually determine the trajectory of its life cycle. Several options possible trajectories of development of a complex system shown in Fig. 1.

Consider variant A. Based on the totality of external and internal conditions at the time of the birth of the system, beginning from its development follows the trajectory 1, but is changing very quickly

due to some important parameters of external or internal environment. The system is forced to move to the next trajectory 3, which corresponds to the new conditions. For some time, the system is more or less steadily developing, but changes occurring in the environment, accumulate so rapidly that the management subsystem does not have time to take timely, effective solutions and business development opportunities loses system and reaches crisis.

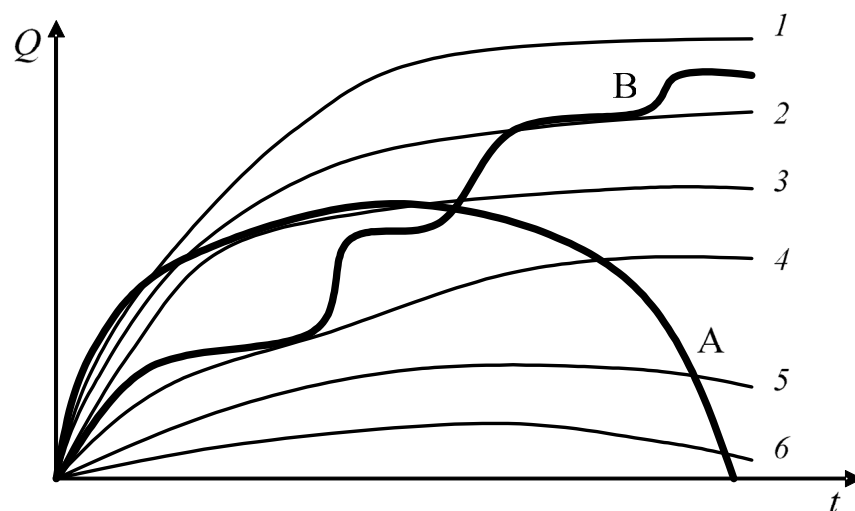


Fig. 1. The set of possible and actual trajectory attractors of the system
(Q – one of the main parameters characterizing the development of the system;
1-6 – the possible trajectory of the system; A, B – the possible development of actual system)

Quite different developing happens for the system B. It's way starts with trajectory 4, but being able to fit into the environment and optimize internal processes, it goes to a higher level of organization and takes the path 2.

The existence of the enterprise should not consist of waiting to slide down the path A. The natural development of any system can be visualized by means of S-shaped or sigmoid curve. Many of the processes that occur in nature, biological, technical, social systems are described by the similar curves. The system is effectively evolving, assimilating many improvements both in technology and in the organization. With a time of slowing growth rates. Usually it happens after emergence and intensification of the contradictions between this system and other systems or upper ones (environment). For a while the system continues to grow, but growth rates are falling, when there is an exhaustion of resources that feed the development

system, aging product engineering principles, loss of customers and more. In the future, the system may remain unchanged for a long time (zone stabilization) or quickly regresses.

Thus, from the standpoint of the theory of catastrophes three main stages of the company:

1) the initial formation of a transitional regime, when the company accumulating matter, energy, information increases and decreases entropy of the enterprise;

2) stable or dynamic equilibrium period when the company is in standby coherent oscillations, which does not exceed the amplitude and frequency under certain limits. Dynamic equilibrium of the whole enterprise is deterministic in the sense that it is objective, and the total amount of resources within the system vary slightly over time, the average remaining constant. This balance is established (dynamic balance) in amounts of matter and energy,

entropy and stability with which the company interacts with the environment;

3) transition, when the company begins to collapse or evolve through a cessation of resources or when they delay a cost of unregulated flow. The amount of resources within the company reduced their consumption exceeds reproduction, and the entropy of the system increases.

Consider the conceptual model, which reflects the need to manage the current and future state of the company at the same time (Fig. 2). The secret of

development is time to move to a new path of development, the new S-shaped curve before the first runs out. The figure shows the point of transition to the new curve, a new round of development (point A - point bifurcation). Point A marks the time when to implement a new strategy of the enterprise. At point B - the beginning of the recession. Changing the strategy at point B or C is too late and measures for strategic development management require too much effort.

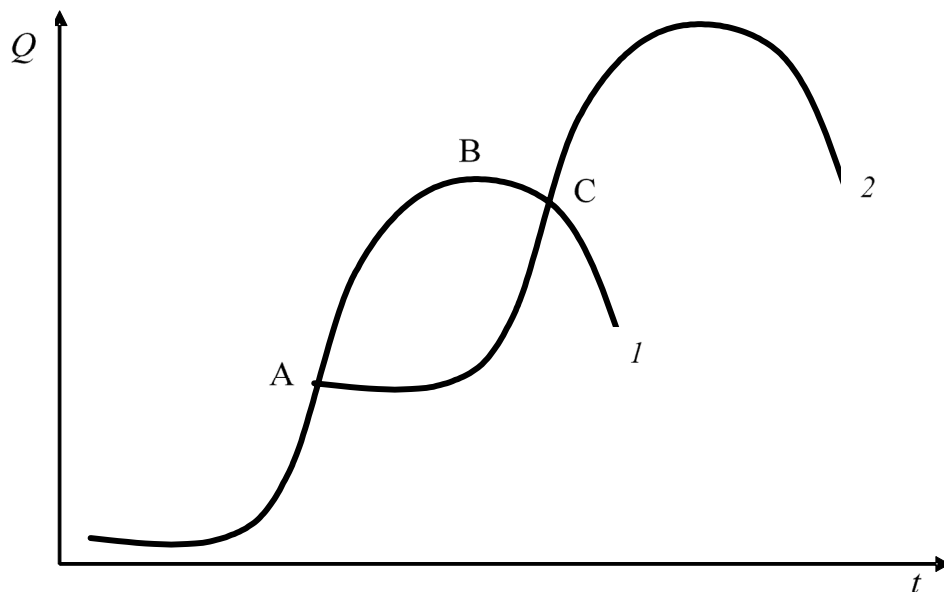


Fig. 2. Development of enterprise using the S-shaped curve concept
(1 – trajectory of the current development, 2 – the trajectory of future development)

The main idea of the trajectory 1 is to most effectively realize the current development strategy based on new organizational models, constant restructuring, improving relations with the environment, modernization of production and so on. The current strategy focuses on improving the performance of current economic activity, but can not create a long-term strategic advantages in the long run. At a time when the leaders of a team working to improve the trajectory 1, the other team leaders should be responsible for the future development of the company. Second team efforts should be directed to the search for new paths of development and the transition from the trajectory 1 to the trajectory 2.

But the balance between the two curves (strategies) poses additional problems for guidance.

K. Blanchard and T. Waghorn in their book "Mission Possible: Becoming a World Class Organization While There's Still Time" formulate the basis of these problems:

- the need to maintain the trajectory 1 long enough so that the trajectory 2 is firmly established;
- the need to plan for the future so as to allow funds to flow from where they were now grouped on path 2 without premature crisis at trajectory 1;
- the need to solve problems that are sure to arise in the simultaneous action of both strategies [5].

Usage of the two trajectories simultaneously is extremely difficult. We must understand that the transition from one curve to another - a jump that requires no evolutionary and revolutionary changes. Evolutionary dimensional transformation, it is limited to movement along the trajectory 1.

Revolutionary transition is two-dimensional. It requires movement on trajectory 1 in conjunction with the creation of the trajectory 2 and the transition to it.

But revolutionary changes should not be too strong, the management should be sensitive to the situation of the company and it is important to determine how much should be limited the discretion of the nearby points of instability, and integrity of the company should not be destroyed. Task management in a situation of instability is to try to preserve the stability of the company while looking for new alternatives to its development. New solutions must be aimed at stimulating the activity of potential, prospective rules and principles of the organization, the values that can improve the enterprise development in a changing environment.

We know that any system is developed under the influence of a large number of factors. The vector of the state administration is on the edge between endogenous and exogenous factors that include a range of possible actions within the company with further definition of trajectory management objectives, which together with vector control economic system (dynamically balanced system of internal factors) determine the degree of ability of the system to adaptation to absorb external disturbances, while maintaining a set of properties of the system. It is the interaction of many factors, while the system determines the possible options for its future development.

Businesses that choose the path of revolutionary change, each time first evaluate your business, your business competitors and customer needs. They start the process of change to how environmental changes force them to do so. Anticipating the changes occurring in the external and internal condition of the company, the control subsystem should be timely to rely on appropriate innovative measures, and the company not only keeps your status, but also develops and holds a better position in the environment.

During the study of the behavior of the enterprise as economic system, one has to remember that any system is only an element of the bigger nonlinear dynamic system. These systems, developing their own laws, determine many of the properties and the circumstances of the subsystems.

Any economic system is an integrity, in which, as in the evolution of any nonlinear dynamical system, there are periods of calm, when there is a slow accumulation of changes, fast changing period of the bifurcation, the period of transition from one trajectory to another. Thus, the development of the company, as well as any other complex dynamic system follows this scheme. Up to some time a company is evolving using some trajectory of development: there is a slow accumulation of new features, but at some point its development loses its stability or consistency alongside with the development of a higher-level enterprise, and a transition to a new path of development is happening.

It is shown that the studied bifurcation points form some possible trajectories of the system behavior. The management parameter defines the steady state of the system to which it is approaching in the course of its development. With the certain values of the management parameter the number of bifurcations (approaching to infinity) is happening, so it becomes difficult to define the system behavior. This study confirms that complex temporal structures are emerging from the chaotic conditions in the self organizing systems; instead of stability and harmony there are evolutionary processes that lead to even greater diversity and complexity of structures.

References

- [1] *Prigogine I.* 1986. Order out of Chaos: Man's New Dialogue with Nature. Moscow. Progress. 432 p. (in Russian)
- [2] *Haken H.* 1982. Synergetik. Springer-Verlag Berlin Heidelberg New York. 367 p.
- [3] *Arnold V.* 1990. Catastrophe Theory. Moscow. Nauka. 128 p. (in Russian)
- [4] *Hayes-Roth F., Waterman D., Lenat D.B.* 1983. Building expert systems. Addison-Wesley. 395 p.
- [5] *Blanchard K., Waghorn T.* 1999. Mission Possible: Becoming a World Class Organization While There's Still Time. McGraw-Hill. 227 p.

Received 01 December 2015.

Н.В Касьянова. Особливості управління розвитком підприємства в умовах кризи

Національний авіаційний університет, просп. Космонавта Комарова, 1, 03680, Київ, Україна

E-mail: nat_kas@ukr.net

У статті обґрунтовано наявності ключових моментів в розвитку економічної системи, вирішення задачі визначення точок бифуркації та вибору на цій основі траєкторії розвитку підприємства. Розглянуто сутність та особливості управління розвитком підприємства в умовах кризи. Запропоновано методичне забезпечення вибору стратегії розвитку підприємства на основі дослідження можливих траєкторій. Науково обґрунтовано практичні аспекти застосування в управлінні підприємством запропонованого методичного забезпечення.

Ключові слова: аттрактор; динамічна система; криза; підприємство; точка бифуркації; траєкторія розвитку.

Н.В Касьянова. Особливості управління розвитком підприємства в умовах кризи

Национальный авиационный университет, просп. Космонавта Комарова, 1, 03680, Киев, Украина

E-mail: nat_kas@ukr.net

В статье обосновано наличия ключевых моментов в развитии экономической системы, решение задачи определения точек бифуркации и выбора на этой основе траектории развития предприятия. Рассмотрены сущность и особенности управления развитием предприятия в условиях кризиса. Предложено методическое обеспечение выбора стратегии развития предприятия на основе исследования возможных траекторий. Научно обоснованно практические аспекты применения в управлении предприятием предложенного методического обеспечения.

Ключевые слова: аттрактор; динамическая система; кризис; предприятие; точка бифуркации; траектория развития.

Kasianova Nataliia. Doctor of Economics. Professor.

Department of Economic Cybernetics, National Aviation University, Kyiv, Ukraine.

Education: Donetsk State University, Donetsk, Ukraine.

Research area: enterprise management development.

Publications: 128.

E-mail: nat_kas@ukr.net