

## **The conceptual model of essential expression of innovative activity adaptive planning mechanism at the mechanical engineering enterprises**

G. Zaharchyn, J. Andreychuk

Department of Personnel Management and Administrating,  
Lviv Polytechnic National University  
79013, Lviv, Banderyst. 12  
e-mail: juljaandrijchuk@rambler.ru

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**Abstract.** In this article we analyzed the recent state and the perspectives of the Ukrainian mechanical engineering complex, characterized main ways to improve the efficiency of this economy sector. Here are determined new quality characteristics of the mechanical engineering enterprise's operational environment. We proposed the classification of existing methods that explain the phenomenon of adaptation and opened their gist. We pointed out the main groups of factors which activate the adaptive planning mechanisms of the innovative activity at the mechanical engineering enterprises. We proposed the definition of "adaptive planning mechanisms of the innovative activity". Here are characterized the components of the adaptive planning mechanisms of the innovative activity at the mechanical engineering enterprises and their influence on its development. We also made prognosis on how enterprises can alternatively demonstrate their adaptive properties, characterized the main phases of mechanical engineering enterprise's development. In this paper we proposed conceptual model of essential expression of innovative activity adaptive planning mechanism at the mechanical engineering enterprises depending on factors which influence it.

**Key words:** mechanical engineering, innovative activity, adaptive planning, factors which activate adaptive mechanisms, phases of innovative development.

### **INTRODUCTION**

Today the mechanical engineering complex is the strategic sector of Ukraine's economy, that significantly affects the state competitiveness, because it produces substantive proportion of the gross domestic product.

Ukrainian economy is composed in such a way that mechanical engineering became "one of the priority branches of industry" [16], "it determines economical, industrial and scientific level of the state, its positions in exports" [19] and "provides transition of society from traditionally industrial to post industrial development phase" [10]. In addition, mechanical engineering is the main, most complex and knowledge-intensive branch of industry which determines the level of sci-tech progress and the growth of labor efficiency in the entire economy, because it provides economy with machinery, equipment, appliances and other technics [8].

Despite of mechanical engineering complex's strategic priority, today scientists ascertain negative tendencies in its development, emphasizing on "the disparity to the world technological requirements, what causes the absence of potentiality to compete the american-euro-asian market leaders" [5] and on "industry structure letdown, as a result of siderurgy and fuel and energy sector product's proportional growth, along with the downfall of mechanical engineering particle [22], in addition with "the absence of clearly defined perspectives, largest disadvantage of what we can assume to be the inefficient company management" [18].

Considering existing difficult conditions, the innovative activity acquires special significance as a potential possibility to get stable competitive benefits on market for boosting overall state competitiveness.

Innovative activity allows the enterprise to get a number of competitive benefits in the conditions of market relations, because new goods and services or new approaches to business management bring economical advantages and a significant enlargement of client base. In analysed literature [23] innovative activity is considered to be the foundation of knowledge based economy.

The necessity to activate the innovative processes at the national industrial enterprises requires the creation of such fundamentally new administrative conception as the adaptive planning of innovative activity, which is formed and functions on absolutely new theoretical and methodological approaches and principals.

#### MATERIALS AND METHODS

Although adaptive management is a quite new kind of administration in scientific sphere, nonetheless theoretical and practical principles of its realization were described by a cohort of national and foreign scientists', namely: [5, 7, 9, 11, 13, 14, 15, 17, 24] and others.

Analysis of scientific literature done by author indicates that on the modern stage of management's theory and practice development problems of adaptive planning are not enough researched, scientific and methodological principles of its organisation are not developed. We should note that only some of the aspects of the specified problem are researched in a few articles and scientific economic profile publications, among which are: theoretical meaning of "adaptation" concept, causal relationships of necessity to build adaptive mechanisms of management, theoretical and methodological foundations of adaptive management's realization, peculiar properties of its informational providing. Fragmentary character and existing differences in scientist's proceedings largely obstruct adaptive management to develop in entrepreneurial environment.

The purpose of the article is to elucidate the conceptual model of essential expression of adaptive planning's mechanism in innovative activity at mechanical engineering enterprises, depending on factors which influence it.

#### RESULTS AND DISCUSSION

According to the results of "The Global Competitiveness Report" we must ascertain a considerable drop of Ukraine's production potential and competitiveness on world market (Ukraine lost 9 positions in a scale of 130 positions in the last 4 years) [6]. Such rating was formed considering different factors, such as state's resource base, the quantity of working population, infrastructure development, size of the markets, technological level of manufacture, level of business culture and many others. Many Ukrainian and

foreign scientists note that the innovative activity is the competitiveness driving factor, because innovations give the companies stable competitive advantages.

However innovations are not self-contained, that's why the expected positive result can be reached only with complex changes on which scientists make emphasis.

[12] focuses on necessity to make a revision of the whole system of mechanical engineering enterprises functioning, starting from its basic principles with the aim to adapt it to the market environment and national conditions of economic development. In author's opinion, the functioning of mechanical engineering enterprise in conditions of market relations puts new requirements to organization of managing process, which on the way of transformation should comply with the market's principles and the principles of sustainable development.

The variability and dynamic of environment in which domestic mechanical engineering enterprises are functioning, risks which became an integral part of a modern economy, are the main prerequisites to use adaptive mechanisms which are based on a diverse and usually dissimilar forms of the phenomenon of adaptation. As scientists claim, successful functioning and development of the modern industrial enterprises are determined by their possibilities to adapt to the changes in the external environment. The effective management is possible only if it is provided by focused and timely adaptation to changing market's conditions of economy [15].

[1] are making a stress upon the phenomenon of adaptation manifestation as the enterprise's capability to react on changes in markets conditions with the purpose to get favorable consequences for its activity.

[5] explains adaptation as a process of systems adjustment to external environment's changes, what will grant the system the most effective regime of its functioning. Similar points of view have other authors [2; 3; 4], they consider adaptation to be a process of economical system's accommodation to external environment's changing conditions. [7] interprets adaptation as a process of purposeful changing of object's settings, structure and properties as a respond to changes that are taking place.

[21] are understanding adaptation as a resource because they see enterprise's adaptive properties first of all as the reserve of firmness, ability to keep relative integrity during periods of company's unstable functioning without essential structure changes in it or without its destruction.

[11] claim that adaptation is a result, or if more specifically, a new state of company which was obtained after a complex of measures had been realized under the influence of inner or outer environment to reconfigure company's internal processes.

All of the above explanations of the phenomenon of adaptation (fig. 1) are logical and correct, but variability of their manifestation foremost depends on factors which influence the management process.

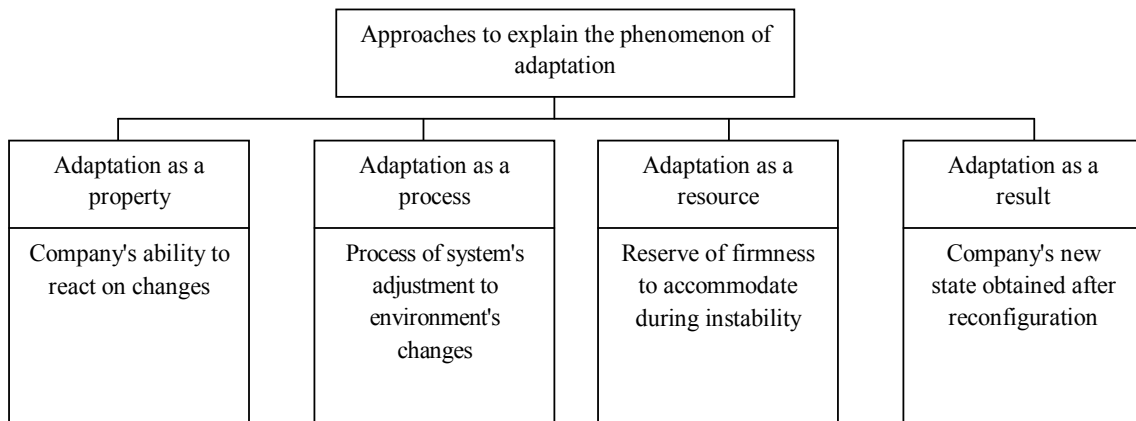
As well, adaptation is interpreted in two actually opposite aspects. In particular, when it is seen as system's adjustment to condition's changes, it will act as absolutely passive property. On the other hand, a system can affect the changes which influence it from the outside. In this case it will act like active property.

There is a classification of complex adaptive system's development variants, which depends on what factors the system is influenced by [20]. This classification can also be used for subjects of the real sector of economy as an instrument to determine mechanical engineering enterprise's phase of development. The classification demonstrates a character of three main influencing features changes which are activating system's adaptive properties (table 1): duration (time) of adaptation process (T), adaptation's activity (A) and the quality of adaptation (Q).

In our opinion, it is advisable to allocate four main groups of factors which influence the system and are activating the mechanism of innovative activity's adaptive planning at mechanical engineering enterprises:

- variability of the environment,
- risks of the activity,
- external threats,
- untapped potential.

In a process of their functioning national mechanical engineering enterprises constantly are being affected by the variability of the environment, what became an inherent property of the modern conditions of management. To main factors of variability belong constant changes in exchange rates, which significantly influences the cost of imported raw materials, export prices and prices of imported products which are competing on market. As well, changing conditions of supply and marketing are forcing mechanical engineering enterprises to adapt their production and sales processes. Inconsistency of global demand caused by change of purchasing power also stimulates enterprise's adaptive mechanisms.



**Fig. 1.** Approaches to explain the phenomenon of the real economy subjects adaptation\*  
Source: author's own development

**Table 1.** Alternative ways of innovative development's adaptive properties manifestation at mechanical engineering enterprises\*

№	Factors that stimulate adaptive planning innovative activities	The essence of the adaptation	Adaptation's activity level	The duration of the adaptation process	The quality of the adaptive process	Innovati develop-ment's phaseve
1	Variability of the environment	Adaptation as a property	Passively-active adaptation	Short-term adaptation	Inefficient adaptation	Decline
2	Risks of activity	Adaptation as a resource	Actively-passive adaptation	Short-term adaptation	Effective adaptation	Development
3	External threats	Adaptation as a process	Passive adaptation	Long-term adaptation	Inefficient adaptation	Depression
4	Untapped potential	Adaptation as a result	Active adaptation	Long-term adaptation	Effective adaptation	Prosperity

\* Source: author's own development.

Constant accommodation to unpredictability and variability of external environment forms adaptive properties of a modern company, however adapting is not fully passive. Partial adjustment of company's production and management activities cause the emergence of short-term actively-passive adaptation to partial oscillations in the activity environment. This indicates a company's transition to the phase of decline (table 2), because the company must constantly accommodate without affecting the environment.

Another ponderable set of factors, which influences company's innovative activity by stimulating its adaptive mechanisms, are risks. The examples of national mechanical engineering enterprise's risks are the opportunity to change principles of taxation, interest rates and customs regulations. Political circumstances in country are another equally important risk, they also can considerably influence company's activity.

A danger that such risks can occur during realization of innovative projects is predicted yet on a planning stage by laying a margin of resource changes for adapting. In such situation adapting is a resource which was initially laid. In short-terms companies are dynamically changing with the aim of further adjustment to identified threats. Such adaptation is considered to be effective, what gives a signal of company's transition to a development phase (table 2).

Sometimes poorly predicted or not fully foreseen risks of environment become threats for enterprises and further are restricting its functioning possibilities and prevent the achieving of the innovative development's goal. If such threats appear, mechanical engineering enterprises must activate the process of adaptation, which provides long-term accommodation to environment for maximum neutralization of possible negative effects. Such adaptation is a fully passive process, because company is in no way trying to influence the environment in which it is functioning and is only adjusting to its conditions, what is considered to be inefficient phenomenon and bring company to a phase of depression (table 2).

In the phase of depression mechanical engineering enterprises have absolutely no effect on market in which they are functioning. All economic conditions are being dictated by competitors, consumers, suppliers, state or other subjects of the external environment. Getting out of that phase is extremely difficult as company is constantly working over accommodation to the conditions, which have already appeared without having possibility to start own development scenarios.

However, there always is untapped potential on the market which can be both internal and external. The example of mechanical engineering enterprise's internal innovative potential are unrealized innovative projects, which will give the manufacturer's sustainable

competitive advantages, unrealized management innovation projects which will improve producing and administrative activity, or marketing innovative products which will help to raise demand for the products. In addition, there can be external unrealized potential such as new markets, unmet needs of consumers or access to cheap outer financial resources. If the company managed to catch out that resource on time and used it, it will make possible the getting of great competitive advantages in the market. Long-term effective change of an enterprise leads to a new qualitative state when the adaptation manifests itself as a result, which brings the mechanical engineering enterprise to the prosperity phase (table 2).

Characterized factors are activating mechanical engineering enterprise's adaptive planning mechanisms of innovative activity. We offer to look at adaptive planning mechanisms of innovative activity as a relationship of elements, tools, technologies and leverages which enable the creation of adaptive planning system of innovative activity and its successful functioning at the enterprise.

None of the economic mechanisms can't function without interim components, which contribute to the goals of the innovative active enterprise, namely: legal, information, resources and organizational and methodological support.

Company's innovative activity among other kinds of activity is perhaps the most regulated and controlled by Ukrainian legislation, because it provides strategic development of the state. Legal basis of adaptive planning mechanism of innovative activity includes laws of Ukraine, Decrees of the President of Ukraine, Regulations and Decrees of the Cabinet of Ministers, orders, Regulations and Orders of Ministries and Departments, etc. All of the above instruments of legal basis are to create institutional frameworks, which will stimulate innovative processes at the enterprise, support innovative development and promote innovative projects at the enterprise.

Modern company functions in a changing and unpredictable competitive environment, that is why on time and relevant informational flows significantly increase the effectiveness of innovative solutions. Informational flows can be both inner (related to enterprise's strengths and weaknesses, available resources, level of the inner potential), and outer (related opportunities and threats of the environment, demand on market, activities of competitors, the price level and the purchasing power of consumers).

Resources support is a material basis of adaptive planning mechanism's of innovative activity as a set of financial, material, nonmaterial, labor, technical and other resources of the enterprise. The financial resources are of particular importance, as innovative projects

require significant investment which are accompanied by time lag after which company begins to receive early cash flow. Equally important are labor resources, because innovative activity needs the appropriate skills and abilities of the staff, and also their desire and a good morale in the team which should not resist the change. The introduction of radical and improving product innovations is not possible without appropriate technical and technological resources, which enable technological development of the enterprise.

Under organizational and methodological support of adaptive planning mechanism of innovative activity we should understand the selection of the optimal organizational structure to maximize the level of adaptability, form associated set of obligations and authorities, internal services and departments that adopt innovative solutions and are responsible for them. Also organizational and methodological support includes complex of administrative and technical measures (rules, procedures, job descriptions, rules and regulations) regulating innovatively active enterprise work.

The influence of interim components of adaptive planning mechanism on mechanical engineering enterprise's activity is displayed in table 3.

Alternative options for manifestation of mechanical engineering enterprise's adaptive properties are underlying the conceptual model of essential expression of adaptive planning's mechanism according to influencing factors (fig. 2).

The proposed model shows that the accretion of adaptive properties should be the priority for every modern mechanical engineering enterprise, which will greatly facilitate its operation in the dynamic, competitive and risky market. The greater are adaptive properties of the company, the more effectively it will be functioning.

CONCLUSIONS

1. The strategic priority of Ukrainian mechanical engineering formed the need for continuous evaluation and analysis of trends in its development. Significant deterioration of its dynamics main indicator's, annual imports growth and decrease in industry exports become the root cause for the unconditional affirmation of the need to review the basic principles of mechanical engineering enterprise's operation. Overcoming of existing problems at the mechanical engineering enterprises, stabilization of their performance and increase of profitability is only possible through the use of effective management.

2. A significant drop in industrial competitiveness requires immediate activation of enterprise's innovative activity. However, the impact of uncertainty, variability and risk on the activities of domestic enterprises necessitates the use of innovative activities adaptive planning in enterprises, which is activated in enterprises as an adaptive mechanism.

**Table 2.**Innovative development's phases of a mechanical engineering enterprises \*

Innovative development's phase	Prosperity	Development	Decline	Depression
Kind of development	Long-term effective progress	Short-term effective progress	Short-term inefficient progress	Long-term inefficient progress
Quality of development	Outstripping development	Moderate growth	Partial decline	Total decline
Competitive position on market	Strong	Strong	Weak	Weak
Quality of innovative development management	High	High	Low	Low
Need for the introduction and improvement of adaptive mechanisms	Moderate	Moderate	High	High

\* Source: author's own development.

**Table 3.** The influence of interim components of adaptive planning mechanism on enterprise's innovative activity \*

Interim components	The influence on enterprise's innovative activity
Legal support	The set of legal acts regulating innovative activity creates favorable conditions for its development, stimulates innovation processes, facilitates the implementation of innovative projects.
Information support	The set of information resources provides information support for making effective management decisions in conditions of adaptation.
Resources support	The set of financial, material, nonmaterial, labor, technical and other resources forms the material basis for the realization of adaptive plans for innovation.
Organizational and methodological support	Complex of administrative and technical measures combined with the organizational elements improve the efficiency of innovative activities adaptive planning, promote transparency of innovative solutions, and provide the highest level of innovation project's adaptability.

\* Source: author's own development.

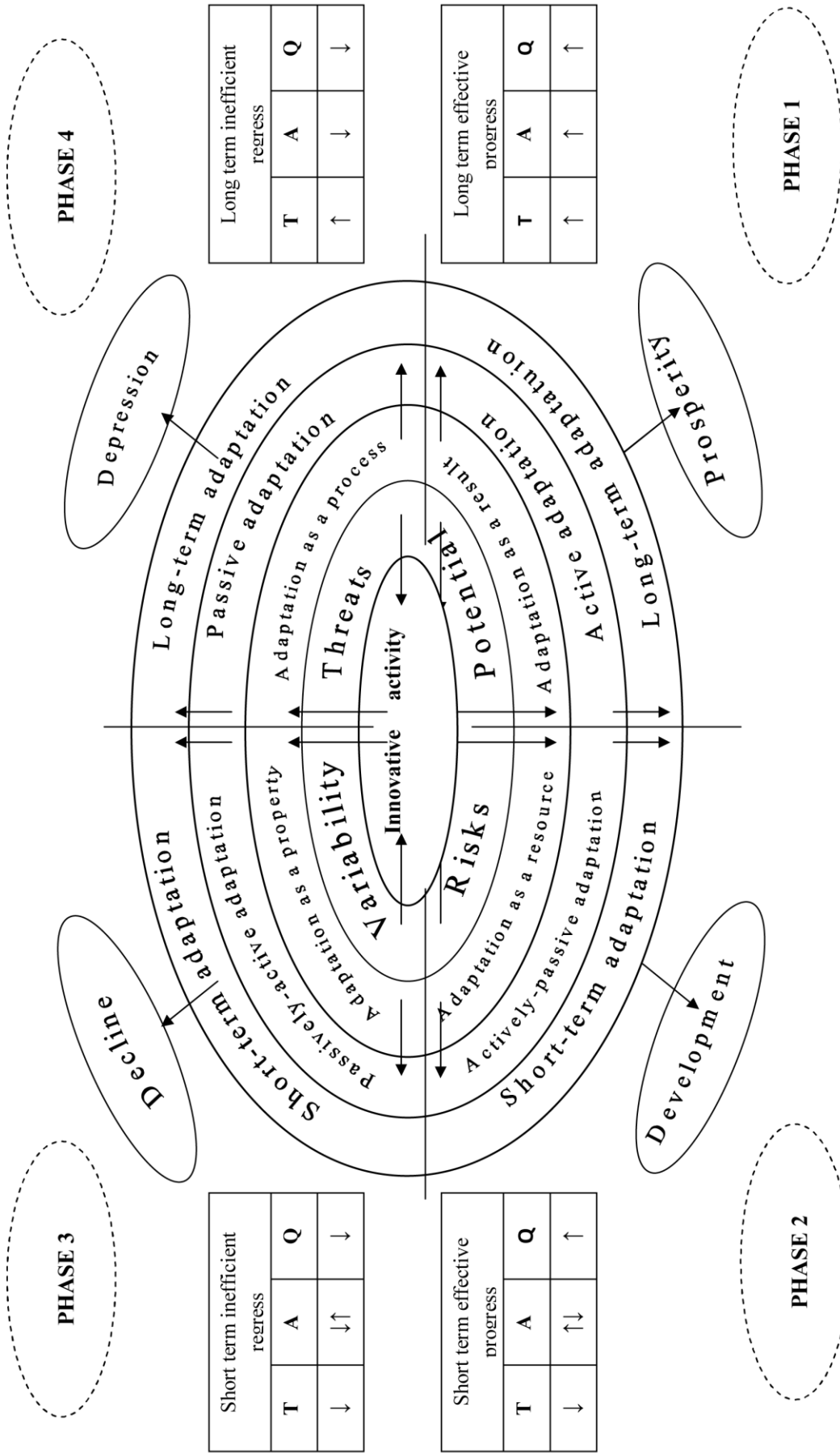


Fig. 2. The conceptual model of essential expression of adaptive mechanism at mechanical engineering enterprises according to influencing factors\*  
 \* Source: author's own development.

3. The adaptive planning mechanism of the innovative activity contributes to the steady state of the innovation-active enterprises, enables the formation of innovative activity adaptive plans, and hence the creation and commercialization of new competitive products to increase the market value of the company, capture new and retain existing market segments, meet social needs and accelerate the pace of scientific progress.

4. Depending on what factors trigger the adaptive mechanisms (volatility, risks, threats or untapped potential) adaptation will take place in one of the four options, namely: as a process, as a property, as a result or as a resource, what indicates a phase of innovative development, which is inherent in mechanical engineering enterprise.

5. The phase of innovative development allows not only to evaluate the position of the company on the market, but also give some recommendations for its further operation.

6. Implementation of adaptive mechanisms for planning the innovative activities on the domestic mechanical engineering enterprises will enhance the effectiveness of innovative projects in particular, and innovative activity of the enterprise as a whole, because they enable the quickest method to identify and adapt to the variability of the external and internal environment of enterprise's functioning, which, in turn, enables enterprises to get the most desired results, new competitive advantages, consumer likes and new market segments.

#### REFERENCES

1. **Akoff R.L., Magidson D. and Eddison G.D. 2007.** Idealizirovannoe proektirovanie: kak predotvratit' zavtrashnij krizis segodnya. Sozdanie budushego organizacii. Balans Biznes Buks, 265. (in Russian).
2. **Barlamova B.P., Vasil'eva N.A. and Negarova L.M. 2007.** Bol'shaya ekonomicheskaya Enciklopediya, Eksmo, 816. (in Russian).
3. **Bol'shoj Enciklopedicheskij slovar'. 1997.** Bol'shaya rossijskaya Enciklopediya, 1456. (in Russian).
4. **Borisov A.B. 2002.** Bol'shoj Enciklopedicheskij slovar', 895. (in Russian).
5. **Filatova Yu.V. 2008.** Adaptaciya ekonomicheskogo povedeniya firmy k sovremennym usloviyam: Avtoref. dis... kand. ekon. nauk: spec. 08.00.01 «Ekonomichna teoriya ta istoriya ekonomichnoyi dumky», 18. (in Ukrainian).
6. **Global Competitiveness Report. 2009-2010.** [Elektronnij resurs] / Rezhim dostupu : <http://www.weforum.org/en/initiatives/gsp/Global%20Competitiveness%20Report/index.htm>.
7. **Goncharov V.N., Dibnis G.I. and Pekin A.Yu. 1993.** Adaptaciya promyshlenyh predpriyatij k nauchno-tehnicheskim novshestvam, 132. (in Russian).
8. **Gutiv G.G. 2013.** Osnovni tendencii rozvitku eksportu produkciji mashinobudivnoï galuzi. Visnik Hmel'nic'kogo nacional'nogo universitetu, Vol.3. Nr 1, 41-44. (in Ukrainian).
9. **Kolodina O.M. 2010.** Teoretichni osnovi sutnosti ta zmistu ekonomichnoyi adaptivnosti pidpriemstva. Visnik Hmel'nic'kogo nacional'nogo universitetu. Nr1, 52-59. (in Ukrainian).
10. **Markovich I.B. 2011.** Analiz tendencij, perspektiv ta rizikiv rozviku svitovogo rinku mashinobuduvannya. Ekonomika Kryma, Nr 2, 181-184. (in Ukrainian).
11. **Morochkovskaya I.N. 2005.** Effektivnost' adaptacii predpriyatiya kak uskorenje. Upravlenie personalom, Nr 20, 44-47. (in Russian).
12. **Mironov R.S. 2012.** Metrologichni zasadi formuvannya efektivnoyi sistemi menedzhmentu mashinobuivnogo pidpriemstva. Visnik Hmel'nic'kogo nacional'nogo universitetu, Nr 5, 99-104. (in Ukrainian).
13. **Ohten' A.A. 2009.** Teoreticheskie osnovy adaptivnogo planirovaniya proizvodstva. Zbirnik naukovih prac' «Naukovij visnik ChDIEU», Nr 4, 101-107. (in Russian).
14. **Otenko V.I. 2009.** Teoretiko-metodologichni aspekty formuvannya sistemy adaptivnogo upravlinnya pidpriemstvom. Naukovyj zhurnal «Ekonomika rozvytku», Nr №1(49), 77-80. (in Ukrainian).
15. **Panishin I.V. 2003.** Adaptacionnyj mehanizm upravleniya potencialom promyshlenogo predpriyatiya: Dis... kand. ekon. nauk: 08.00.05, 174. (in Russian).
16. **Perevozchikova N.O. and Lukashova O.O. 2013.** Mashinobuduvannya Ukrayini: stan v period aktivizaciyi integracijnih vidnosin derzhavi. Visnik Hmel'nic'kogo nacional'nogo universitetu, Nr №2, 164-168. (in Ukrainian).
17. **Petrishin N.Ya. 2009.** Adaptacijni tehnologiyi strategichnogo planuvannya diyal'nosti mashinobudivnih pidpriemstv. Aktual'ni skladovi regional'nogo rozvitku v konteksti evropejs'koyi integraciyi: zbirnik tez, 163-164. (in Ukrainian).
18. **Pihur I.V. 2012.** Ocinka suchasnogo stanu rozvitku pidpriemstv promislovosti Ukrayini. Visnik Hmel'nic'kogo nacional'nogo universitetu, Nr 5, 244-247. (in Ukrainian).
19. **Tarasova N.V., Klimentko L.P. and Emel'yanov V.M. 2011.** Promislovist' Ukrayini: tendenciyi, problemi, perspektivi, 230. (in Ukrainian).
20. **Pushnoi G.S. 2004.** Application of Method of System Potential for Analysis of Economic System Evolution. Paper presented at the Second Internet Conference on Evolutionary Economics and Econophysics.
21. **Rusinov F.M., Larin V.M. and Gusarov Yu.V. 1996.** Organizaciya upravleniya gosudarstvennymi i komercheskimi strukturami v novyh usloviyah hozyajstvennosti, Nr 11, 3-16. (in Russian).
22. **Sergijchuk S.I., Karas' P.M. and Grishina L.O. 2013.** Providni napryami ekonomichnogo ta social'nogo rozvitku nacional'noyi ekonomiki. Visnik Hmel'nic'kogo nacional'nogo universitetu, Nr 1, 240-245. (in Ukrainian).
23. **Simonenko D.S. 2009.** Problemi planuvannya innovacijnoyi diyal'nosti pidpriemstva. Ekonomichni innovaciyi, Nr 38, 189-195. (in Ukrainian).
24. **Vinogradova O.R. 2011.** Adaptivne planuvannya virobництва na promislovih pidpriemstvah : avtoref. dis. ... kond. ekon. nauk : 08.00.04, 20. (in Ukrainian).

