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THE ROLE OF INNOVATIVE TECHNOLOGIES IN ENSURING THE COMPETITIVENESS OF THE ENTERPRISE

Purpose. To establish the reasons for the slowdown of the innovation process in Ukraine and the Ukrainian peculiarities of this process in providing competitive advantage. To develop a conceptual model of the impact of information technology on the formation of competitive advantages.

Methodology. The research uses general and special methods of cognition: content analysis for an analytical review of the literature, identifying unresolved aspects of the problem; induction and deduction to establish conditions for formation of a positive impact of innovations on competitiveness; system analysis to establish the reasons for slowing down the innovation process; going from the abstract to the concrete to establish why changes in sustainable development do not outweigh the costs of innovation in Ukraine; idealization to establish new opportunities that open innovations for Economy 4.0; modeling for the development of scheme support system for management decisions regarding innovations and the conceptual model of algorithm of the intelligent system support and decision-making regarding operational and strategic management of innovation process.

Findings. The following was established: the nature of the relationship between the introduction of innovations and the acquisition of competitive advantages; conditions for the formation of the positive impact of innovation on competitiveness; reasons for slowing down the innovation process. It is stated that the application of the latest technologies opens new opportunities for gaining competitive advantages. These opportunities were stratified depending on the impact on competitiveness. It is substantiated that innovations serve not only as a tool to increase competitiveness, but also contribute to the movement towards Economy 4.0.

Originality. Tools for coordination of operational and strategic management of innovations were proposed. An algorithm of the conceptual model of the innovation decision-making system was developed for the effective implementation of strategic management.

Practical value. The developed approaches to support management decisions of the innovation process can increase the efficiency of introducing innovation at enterprises.

Keywords: *innovation process, competitiveness, strategic planning, conceptual model, IT-technologies*

Introduction. The problem of ensuring the appropriate level of competitiveness applies to all levels of the economy: national, regional and sectoral, large, medium and small enterprises. The level of competitiveness is the main characteristic of any economic entity of entrepreneurial activity, regardless of the type or scale of this activity.

The solution of this problem has a special role for Ukrainian enterprises, which operate under constant extremely harsh conditions of economic, political and military crisis. This is largely a deterrent to increasing the level of competitiveness for innovation in Ukraine. Therefore, even for companies whose management understands the importance of innovation, its implementation is not systemic.

This leads to the fact that the management of Ukrainian enterprises does not always have practical experience in the planned continuous innovation process of reforming all areas of activity: production, organization, management to create competitive advantages at domestic and, moreover, at international markets.

The Ukrainian economy is still at the initial stage of transition to an innovative type. Therefore, the adaptive capabilities of the microeconomic level are beginning to play a special role, because it is at the enterprise level that numerous technological innovations are tested, and the latest scientific and technical developments are commercialized. Innovative factors under effective management should become determinants for increasing the competitiveness of the country's economy and gaining permanent competitiveness growth.

Depending on the conditions, the sustainable nature of the innovation process leads, directly or indirectly, to an increase in the level of competitiveness, and the growth of the level of competitiveness has a multiplier effect on the development of the innovation process.

Literature review. An analytical review of Hermundsdotir F. and Aspelund A. research on the relationship between innovation and competitiveness and the contextual factors that contribute to this relationship is given in [1]. The study by Perevozova I., et al. [2] identified factors in the competitiveness of innovative enterprises through the use of innovation management. The study by Marczewska M., Jaskanis A., Kosztrzewski M. [3] is devoted to competitive advantages based on knowledge and technology, identifying the source of knowledge and competencies of companies in obtaining the advantages. Baharun R., et al. [4] showed that the presence of latent average differences in the factor structure of the second order for self-assessment of competencies was confirmed. Dezi L., et al. [5] pointed out that the focus of companies on knowledge management technology (KM) helps in the process of acquisition, exchange and transfer of knowledge, i.e. improves their ambidexterity and competitiveness. The article by Bai Y., et al. [6] considers environmental innovation as a tool to increase the level of competitiveness, as it promotes direct foreign investments and the return of technology to promote innovation. Using the structure of abilities, motivation and opportunities (AMO) the study by Balanovska T., Havrysh O., Gogulya O. [7] proves that the practice of improving the AMO of project organizations leads to better innovation efficiency of their employees, i.e. increasing the competitiveness of the firm due to their role in knowledge sharing. Nagano H. [8] pointed

out that the possibility of increasing the knowledge and competitiveness of companies in the resource-based view (RBV) and the importance of strategic management in this process is studied. The article by Tian Q., et al. [9] identified seven main factors that affect competitiveness: innovation, public policy, entrepreneurship, culture and strategy, technology, human resources and organizational capabilities. In the research of Filho V.A.V., Moori R.G. [10] the interdisciplinary approach is used to combine the strategic orientation of management with technological capabilities as a significant factor of competitive advantage. The mediating nature of the impact of technological opportunities on competitive advantage is proved. The study by Efendi S., et al. [11] examines the mediating effect of innovation in relation to organizational factors and simulation of the ability to competitive advantage. Rojek D. [12] reveals a set of strategic factors of innovation, identifies internal factors that affect the competitiveness of enterprises in the strategic perspective. The publication by Bazaluk O., et al. [13] examines the impact of technology transfer on improving the competitiveness of companies. Temchenko H., Astafieva K., Bondarchuk O. [14] points out that effective management of the innovation process is the key to increasing the competitiveness of production in market conditions. Sunigovets O. [15] considers the digital economy as the main direction of innovation, growth of competitiveness and economic development of enterprises. The study by Cao Y. [16] examined the relationship between technological innovation and the competitiveness of enterprises in Kenya. The study by Gordon L.A., et al. [17] is devoted to the inevitable direction in the activities of enterprises to ensure not only competitiveness but also survival – the use of modern information security systems. The work by Yevseiev S., Shmatko O., Romashchenko N. [18] proves that modern technologies for ensuring the appropriate level of competitiveness are based on modern algorithms, in particular, the assessment of the level of information security risk, which is realized through the apparatus of fuzzy logic. Wang D. [19] studied the role of information technologies in the creation and application of innovative business models.

Unsolved aspects of the problem. The analytical review of literature sources while identifying the role of innovative technologies in ensuring the competitiveness of the enterprise indicated that together with significant detailing of various aspects of this scientific direction, identifying reasons for slowing down the innovation process in Ukraine and studying the peculiarities of this process require detailed research. The urgency of practical and scientific need in the development of a conceptual model of the impact of information technology on the formation of competitive advantages and formalization of the scheme of block implementation of the system of support for management decisions of the innovation process is established.

The purpose of the article. To study the reasons for the slowdown of the innovation process in Ukraine and the peculiarities of this process in providing competitive advantage. To develop a conceptual model of the impact of information technology on the formation of competitive advantages.

Methods. General and special methods of cognition were used to conduct the presented research. The method of content analysis is used for analytical review of the literature and identifying unresolved aspects of the problem. The method of induction and deduction was applied to establish the nature of the relationship between the process of introducing innovations and the acquisition of competitive advantages. The method of abstraction was used to establish the nature of the relationship between the process of innovation and gaining competitive advantage. The method of generalization was used to establish the conditions for the formation of the positive nature of the impact of innovation on the level of competitiveness of enterprises. The method of system analysis was used to determine the reasons for the slowdown of the innovation process in Ukraine.

Using the method of ascent from the abstract to the concrete allowed us to conclude that the changes in sustainable development associated with the formation of business opportunities in Ukraine are not so significant and so numerous at the enterprise level that they still outweigh the costs of innovation.

The method of idealization allowed us to establish that the acquisition of competitive advantages, which opens the introduction of innovations, and the formation of new opportunities, create the preconditions for the movement of the enterprise to the Economy 4.0.

The modeling method was used to develop a scheme of block implementation of the system of support for management decisions to increase the efficiency of the innovation process and a conceptual model of the algorithm of the intelligent support system and decision-making regarding operational and strategic management of the innovation process.

Results. The first step is to determine the ambivalent nature of the relationship between the process of innovation and gaining competitive advantage at the market.

The positive nature of the impact of innovation on the level of competitiveness of enterprises is undeniable, but it is not the only unconditional factor in ensuring a win-win position in the market.

The dependence of competitive advantages and the level of innovative development of the enterprise is complex, and there are many factors that have a mitigating or mediating effect as to the impact of innovation on competitiveness.

The uneven, aperiodic nature of the innovation process is indicated by the data shown in Table 1. Certain peak values of the number of innovative products sold in 2012, 2014, 2016 and 2018 are replaced by a decrease in the number of innovative products in the coming years.

Significant fluctuations of the innovations introduced into production are also characteristic, when the “record” values of 2014 and 2016 (respectively 1,314 and 1,305 units) are replaced by a reduction in subsequent years by more than 1.5 times. And, in general, the number of innovations introduced into production in 2007 in relation to 2020 is 1.36, i.e. there is a decline of 36 %.

During the analyzed period, the innovation process provided truly new products and machines into the market in the range from 978 to 477 units, with the lowest value for 2017 relatively stable for the country’s economy compared to previous or subsequent years. This, in particular, also indicates the level of ambivalence of the impact of innovation on the competitive state of enterprises.

At the same time the data presented in Table in general indicate a growing understanding by the management of enterprises of the importance of the role of the innovation process in ensuring market position. The long-term (2007–2020) trend of increasing the share of the number of industrial enterprises implementing innovations in the total number of industrial enterprises from 10–11 % at the beginning of the study period to ~15 % at the end of this period is the proof of this (Table).

Conditions for the formation of the positive nature of the impact of innovation on the level of competitiveness of enterprises are:

- effective long-term planning of the innovation process;
- resource and organizational support of the complexity of the innovation process;
- organization of the innovation process as a set of projects and application of the project approach;
- taking into account the fact that the innovation process is not static but dynamic and the factors of influence at each stage may act in different, not always expected ways;
- the innovation process is risky and therefore requires special risk management.

The complexity of the innovation process means the multifaceted nature of its impact on internal and external activities

Implementation of innovations at industrial enterprises

Years	Share of the number of industrial enterprises implementing innovations in the total number of industrial enterprises, %	The number of innovative products implemented in the reporting year, units	of which		Share of the volume of the sold innovative production in the total volume of the sold production of industrial enterprises, %
			new for the market	machines, equipment implemented	
2007	11.5	2,526	881	881	6.7
2008	10.8	2,446	840	758	5.9
2009	10.7	2,685	719	641	4.8
2010	11.5	2,408	606	663	3.8
2011	12.8	3,238	900	897	3.8
2012	13.6	3,403	672	942	3.3
2013	13.6	3,138	640	809	3.3
2014	12.1	3,661	540	1,314	2.5
2015	15.2	3,136	548	966	1.4
2016	16.6	4,139	978	1,305	no data available
2017	14.3	2,387	477	751	0.7
2018	15.6	3,843	968	920	0.8
2019	13.8	2,148	418	760	1.3
2020	14.9	4,066	691	647	1.9

Note: * forecast data to the State Statistics Service of Ukraine

of the enterprise. To ensure the appropriate level of efficiency of the innovation process, each direction of this influence must receive full resource and organizational support.

The analysis identified the reasons for the slowdown in the innovation process in Ukraine. For the sake of analysis, the factors influencing the innovation process were divided into groups: national, market and industry factors.

In addition to a number of external factors – the negative effects of the permanent crisis, the threat of destruction due to hostilities, etc., there is a group of factors that cause improper pace of innovation in Ukrainian enterprises. These include:

1. The stimulating nature of external norms, values and traditions for Ukrainian enterprises have less impact on the innovation process than in developed countries. Moreover, conservative traditions help to curb innovation rather than promote it.

2. A systemic nature of technological backwardness which is inherent in the majority of Ukrainian enterprises, the use of Soviet technologies and equipment, energy consumption and material and labor intensity, and the permanent shortage of resources, especially financial. This all causes the need not for point innovations, but for total restructuring.

3. A variety of effective institutions for the production of scientific and technological knowledge, proper financial incentives for the most successful producers of such knowledge which is a prerequisite for innovation in developed countries is largely reduced in Ukraine in the conditions of social crisis.

4. There is some pressure from the owners on the management of enterprises with the requirement to ensure the greatest profit in the shortest possible time, i.e. reducing the payback period. Thus, guaranteeing short payback periods in times of crisis is impossible.

5. Competition in the internal market does not yet stimulate the innovation process properly. Access to foreign markets requires the appropriate technological, financial, managerial level from the management of enterprises. But the crisis is reducing the window of opportunity to enter foreign markets, and this, in turn, leads to a slowdown in the innovation process.

6. In developed countries, the innovation process is dominated by the component of sustainable development innova-

tion, aimed at creating more value, reducing costs and forming non-financial assets. Thus, innovations in the sphere of sustainable development contribute to both changes in sustainability and the formation of competitive advantage. In Ukraine due to the effects of the crisis the formation of the economy of sustainable development is not of a constant aperiodic nature, which eliminates the stimulation of the innovation component of sustainable development. This allows us to formulate the thesis that in Ukraine the changes in sustainable development associated with the creation of business opportunities are not so significant and so numerous at the enterprise level that they outweigh the costs of innovation.

7. The introduction of social and environmental innovations at the level of Ukrainian enterprises under the current conditions of state incentives and improper organization of control, low level of public influence and the desire of management and owners to reduce costs are rare.

The innovation process was also characteristic of enterprises of the early industrial period. Update of production technologies is the basis of production activity at all times.

Our time, the transition to Industry 5.0, is characterized not only by innovations in the sphere of modern digital technologies. It is characterized by the permanence of the innovation process of companies in all spheres of activity, not just industrial enterprises.

The innovation process today is so complex that it requires the use of a special decision support system (DSS) to manage the innovation process. Coordination of operational and strategic management of the innovation process requires special attention. An example of the consequences of inconsistency in this regard is the development and implementation of innovative R&D at Ukrainian enterprises. In most cases, the customer aims to minimize DSS design costs. A strategic evaluation of the expediency of using methods, tools, and programming language is not conducted. Software tools become obsolete quickly, programming languages that are popular today are often replaced by other languages. If it is necessary to modernize the DSS over time, this leads to significant costs, or, in general, it requires not modernization, but a complete redesign of the system. This is characteristic not only of Ukraine. For example, the innovative information system of the EU "SeaData-

Net” has been completely redesigned three times due to the impossibility of its current modernization.

The block implementation proposed by us for the algorithm of the whole system is presented in Fig. 1.

Stages of implementation of the support system for management decisions of the innovation process, represented by blocks “Analysis of the need for innovation”, “Risk analysis of the innovation process”, “Innovation process planning”, “Resource support of the innovation process”, “Training or preparation of personnel”, “IT consulting support” should cover the full range of management actions on these issues.

The final block “Analysis of the completeness of achieving the result” (Fig. 1) should prove or disprove the effectiveness of achieving the intended objectives of the project.

The whole process should be accompanied by careful monitoring of all aspects of the innovation project and adjusted by management actions, both operational and strategic ones.

The whole process should be accompanied by careful monitoring of all aspects of the innovation project and adjusted by management actions, both operational and strategic.

The use of the latest technologies opens up new opportunities for gaining competitive advantages (or, for the introduction of these technologies by competitors – the opportunity not to fall behind) in particular:

- using new concepts of enterprise management;
- opportunities for their implementation;
- use of new means of communication to improve work in all directions; between departments, with suppliers and customers;
- acquisition of new solutions in the production sphere, marketing, organization, and others;
- increase in productivity and adapting to external conditions;
- reducing the duration of the production cycle (or its stage), increasing the speed of services;
- increasing the quality of products/services;
- expanding market presence.

Thus, innovations are not only a tool for gaining competitive advantage, but they also play an important role in the movement of the enterprise to the Economy 4.0.

An effective innovation process is not possible without proper organization of innovation management. Not only the

management and owners but also the entire staff of the enterprise must be aware of the importance of innovation not only in ensuring the proper level of competitiveness of the enterprise but also in its viability.

The organization of continuous monitoring of customer expectations, activities of competitors, factors and conditions of the market environment is the task of innovation management. This should create a basis for determining the directions of the innovation process and stratification of these directions according to significance and importance, identifying priorities and tasks in the sphere of innovation and forming a strategy for the transformation process to change key competencies to ensure sustainable competitive advantage and appropriate level of strategic adaptation to market conditions.

Effective organization of innovation management should be comprehensive, systematic, and replace some disordered areas of innovation, aperiodic innovation processes provided by individual enthusiasts, into a single system, where each unit, each part of the company aims to achieve the main goal – ensuring the proper level competitiveness of the enterprise.

Therefore, the specified organization of innovation management should form planned balanced activities of the personnel.

Such an organization of innovation process management should be characterized by flexibility of management actions and efficiency of decisions to neutralize threats and effectively ensure the realization of the potential for the formation of competitive advantages.

The achievement of operational and strategic goals of the innovation process should also be coordinated. Otherwise, the result of the eclecticism of the innovation implementation process will be the growth of economic losses at the next stage of innovation implementation and their adaptation to changing conditions in a strategic perspective.

Strategic management of the innovation process should be accompanied by strategic planning of this process.

In turn, strategic planning of the innovation process should be based on preliminary analysis and forecast in the following areas:

1. Identification of promising areas of innovation that are critical to the company’s activities.
2. Research on how these areas are related, the presence or absence of synergistic effects from their interaction.
3. Assessment of the level of competencies and skills of the company’s specialists in these innovative areas.
4. Assessment of the ability to integrate knowledge flows in these areas.
5. Assessment of the competitive position of the own company and competing companies in these innovative areas.
6. Study on prospects for the evolution of knowledge in these areas and possible problems for the company in this evolution.
7. Building a decision tree with the prospects for the evolution of knowledge in these areas and maintaining the existing competitive position.
8. Drawing up and adhering to the strategy of knowledge development for knowledge-based creation.

For the effective implementation of the strategic management of the innovation process as a complex system phenomenon and, in particular, the determination of the place and role of strategic planning to ensure effective management, a conceptual model of the algorithm of the intelligent system of support and decision-making regarding operational and strategic management of the innovation process was developed (Fig. 2). It is the intellectual system of support and decision-making regarding the operational and strategic management of the innovation process that embodies the introduction of modern information technologies into the operational and strategic planning of innovative activities of enterprises. The development of the specified algorithm is due to: the need to forecast the impact of all influencing factors on the result of the innova-

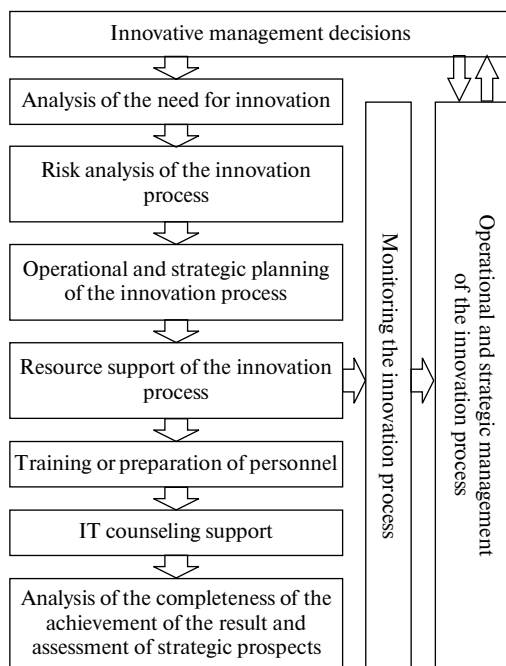


Fig. 1. Block diagram of the decision-making support system for operational-strategic management of the innovation process

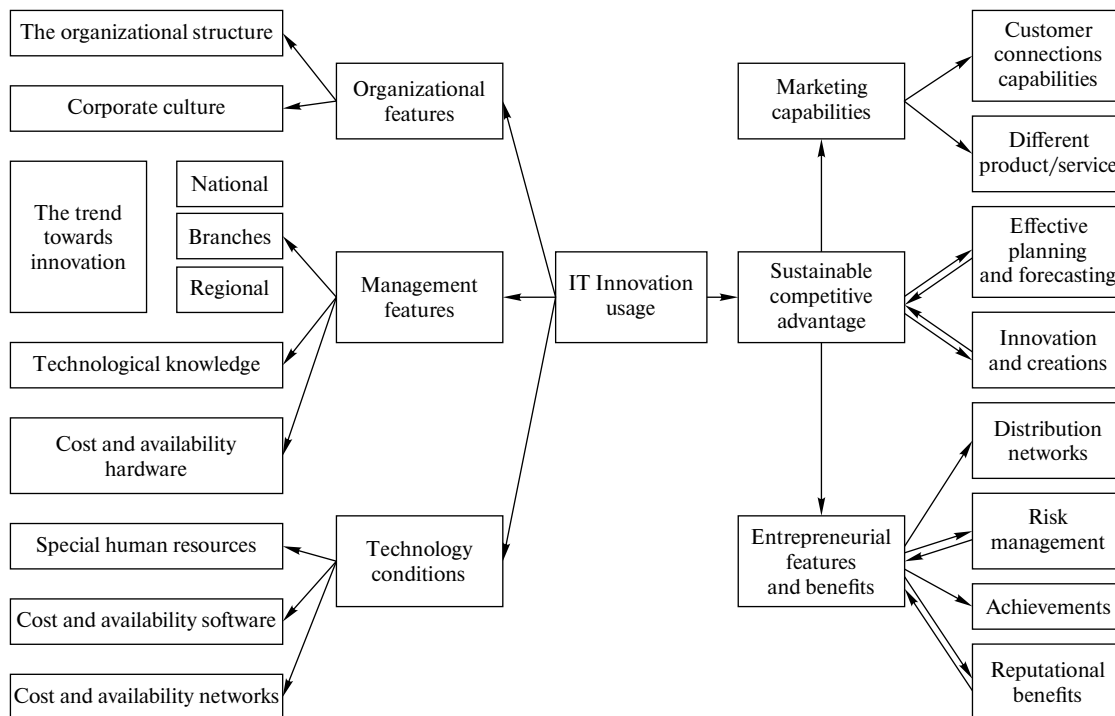


Fig. 2. Conceptual model of the algorithm of the intelligent system of support and decision-making regarding operational and strategic management of the innovation process

tion process in an operational and strategic perspective; the need to coordinate the operational and strategic goals of innovation implementation. But, mainly, the need to develop the specified algorithm is due to the fact that there are no intelligent decision support systems in this area in Ukraine. Such developments have not been found in the scientific literature.

In the developed conceptual model of the intelligent DSS algorithm, consideration is given to the need to analyze the values and rates of change in organizational perspectives, system implementation, attention to management peculiarities, technological conditions, marketing opportunities, the reliability of ensuring sustainable competitive advantages of innovations, attention to their entrepreneurial peculiarities and advantages, taking into account sub-blocks of influence on these model components. The developed model indicates the levels of coordination of operational and strategic planning: organizational, managerial and technological. Examples of possible consequences of inconsistency at the technological level are given above.

Regardless of whether the subject of innovation is information technology, the importance and non-alternative use of it for the effectiveness of the formation of a sustainable level of competitive advantage is indicated. In general, the effectiveness of the proposed conceptual model is ensured by the implementation of a systematic approach to the management and planning of the innovation process.

Conclusions. The study established the ambivalent nature of the relationship between the process of innovation and gaining competitive advantage in the market.

It is pointed out that despite the positive nature of the impact of innovation on the level of competitiveness of enterprises which is irrefutable, it is not the only unconditional factor in ensuring a win-win position in the market.

It is established that the dependence of competitive advantages and the level of innovative development of the enterprise is complex, and there are many factors that have a mitigating or mediating effect on the impact of innovation on competitiveness.

The conditions for the formation of the positive nature of the impact of innovation on the level of competitiveness of enterprises are established.

It is indicated that the complexity of the innovation process is one of the main conditions for the effectiveness of innovation in ensuring the market position of the enterprise. This complexity is formed by the multifaceted impact of the innovation process on the internal and external activities of the enterprise.

Each of the areas must receive full resource and organizational support in order to effectively implement the complexity of the innovation process.

For the sake of analysis, the factors influencing the innovation process were divided into groups: national, market and industry ones, which allowed us to identify the reasons for the slowdown of the innovation process in Ukraine.

It is established that in the Ukrainian conditions due to the effects of the crisis the formation of the economy of sustainable development is of non-permanent and aperiodic character. And this eliminates the stimulation of the innovative component of sustainable development. This allowed us to conclude that in Ukraine, changes in sustainable development associated with the creation of business opportunities are not so significant and so numerous at the enterprise level, so they do not yet stimulate enterprises to spend on innovations. In turn, this significantly hinders the introduction of innovations that are significant in solving social and environmental problems.

It is pointed out that since the process of implementing the latest technologies is complex at present, it requires the use of a special system to support management decisions of the innovation process. The scheme of block realization of this system is developed for this purpose.

It is stated that the application of the latest technologies opens new opportunities for gaining competitive advantages. These opportunities are stratified depending on their impact on the competitiveness of the enterprise.

It is pointed out that the established opportunities prove that innovations serve not only as a tool for gaining competitive advantages, but also play an important role in shaping the movement of the enterprise to the Economy 4.0.

The need for strategic management of the innovation process to ensure the effectiveness of its results has been identified.

It is stated that strategic management of the innovation process should be accompanied by strategic planning.

The directions of realization of strategic planning by the innovation process are established.

A conceptual model of application of information technology for the formation of a sustainable level of competitive advantage is developed for the effective implementation of strategic management of the innovation process as a complex systemic phenomenon.

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Роль інноваційних технологій у забезпеченні конкурентоспроможності підприємства

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Мета. Встановити причини уповільнення інноваційного процесу в Україні та українські особливості цього процесу в забезпеченні конкурентних переваг. Розробити концептуальну модель впливу інформаційних технологій на формування конкурентних переваг.

Методика. У дослідженні використані загальні та спеціальні методи пізнання: контент-аналізу для аналітичного огляду літератури, виявлення невіршених аспектів проблеми; індукції й дедукції для встановлення умов формування позитивного впливу інновацій на конкурентоспроможність; системного аналізу для встановлення причин уповільнення інноваційного процесу; сходження від абстрактного до конкретного для встановлення чому зміни сталого розвитку не переважають в Україні витрати на інновації; ідеалізації для встановлення нових можливостей, що відкривають інновації для Економіки 4.0; моделювання для розроблення схеми системи підтримки управлінських рішень щодо інновацій і концептуальної моделі алгоритму інтелектуальної системи підтримки та прийняття рішень щодо оперативного та стратегічного управління інноваційним процесом.

Результати. Установлені: характер взаємозв'язку між упровадженням інновацій і набуттям конкурентних переваг; умови формування позитивного впливу інновацій на конкурентоспроможність; причини уповільнення інноваційного процесу. Указано, що застосування новітніх технологій відкриває нові можливості для набування конкурентних переваг. Ці можливості стратифіковані в залежності від впливу на конкурентоспроможність. Обґрунтовано, що інновації слугують не лише інструментом збільшення конкурентоспроможності, але й сприяють руху до Економіки 4.0.

Наукова новизна. Запропоновані інструменти узгодження оперативного та стратегічного управління інноваціями. Для ефективної реалізації стратегічного управління розроблено алгоритм концептуальної моделі системи прийняття рішень щодо інновацій.

Практична значимість. Розроблені підходи підтримки управлінських рішень інноваційного процесу дозволяють збільшити ефективність упровадження інновацій на підприємствах.

Ключові слова: інноваційний процес, конкурентоспроможність, стратегічне планування, концептуальна модель, IT-технології

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