FEATURES OF FUNCTIONING OF INNOVATIVE DEVELOPMENT OF ENTERPRISES WITHIN THE FRAME OF TECHNOLOGY PARK

Soltsev S. O., Gnitetskyi Ie. V.

The aim of this article is to study the theoretical and methodological basics of innovative development of enterprises within the frame of technology park. During the study methods of system-structural analysis were used for allocation of stages of the innovative development of enterprises and their functioning within the frame of technology park; retrospective method was used for analyzing the evolution of concepts of the innovations theory. As a result of the study was suggested to attract enterprises by means of market-based instruments and to evaluate the viability of innovations’ implementation on basis of the sustainable development criteria. A study on functioning of enterprises within the frame of technology park has allowed to improve their functioning phases, based on complex interaction of the technology park members. Stages of innovative development of enterprises with a view to enhancing the efficiency of their interaction with the technology parks were allocated. A further study for the sector-specific issues of innovative development of enterprises within the frame of technology park is required. Practical significance of the obtained results provides an activation of innovation activity of enterprises. Social impact is seen in achieving the social and environmental effects from functioning of enterprises within the frame of technology park on the basis of elaborated stages. Value of the scientific work consists in use of market mechanisms for attracting enterprises to technology parks without involving of any State subsidies.

Key words: innovation activity, innovation activity of enterprises, technology park, functioning of enterprises.


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Сільська О. С., Гнитецький Є. В. Особливості функціонування та інноваційного розвитку підприємств у межах технопарку

Метою статті є дослідження теоретичних і методичних засад функціонування та інноваційного розвитку підприємств у межах технопарку.

У процесі дослідження використано методи системно-структурного аналізу – для виокремлення етапів інноваційного розвитку підприємств та їх функціонування в межах технопарку; ретроспективний метод – для аналізу впливу понять теорії інновацій. У результаті дослідження запропоновано заплани ринкових механізмів для залучення підприємств без включення державних вкладень і підприємств, що базуються на комплексній взаємодії учасників технопарку. Зазначені этапи інноваційного розвитку підприємств із метою підвищення ефективності їх взаємодії з технопарками. Підготовлені рекомендації щодо забезпечення підприємств ефективними засобами для впливу на формування технопарків.

Ключові слова: інноваційна діяльність, інноваційна діяльність підприємств, технопарк, функціонування підприємств.

Рис.: 2. Табл.: 1. Формули: 1. Бібл.: 15.

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Солнцев С. А., Гнитецкий Е. В. Особенности функционирования инновационного развития предприятий в рамках технопарка

Целью статьи является исследование теоретических и методических основ функционирования инновационного развития предприятий в рамках технопарка. В процессе исследования использованы методы системно-структурного анализа – для выделения этапов инновационного развития предприятий и их функционирования в рамках технопарка; ретроспективный метод – для анализа эволюции понятий теории инноваций. В результате исследования предложено привлекать предприятия за счет рыночных рычагов и проводить оценку перспективности внедрения инноваций по критериям устойчивого развития. Исследование процесса функционирования предприятий в рамках технопарка позволило усовершенствовать этапы их функционирования, основанные на комплексном взаимодействии участников технопарка. Определены этапы инновационного развития предприятий с целью повышения эффективности их взаимодействия с технопарками. Дальнейшее исследование требует оценки отраслевой специфики инновационного развития предприятий в рамках технопарка. Практическое значение полученных результатов заключается в активизации инновационной деятельности предприятий. Социальные последствия – в достижении социальных и экологических эффектов от функционирования предприятий в рамках технопарка по разработанным этапам. Цена работы состоит в применении рыночных механизмов привлечения предприятий к технопаркам без необходимости государственных вложений.

Ключевые слова: инновационная деятельность, инновационная деятельность предприятий, технопарк, функционирование предприятий.

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The analysis of global experience proves that ensuring the economic growth of the country in general and of separate economic entities in particular requires relevant conditions and mechanisms which will foster the development of innovative activity. The transfer of scientific knowledge in new technologies and goods ensures the continuous economic development as evidenced by development of the leading EU countries. Thus, the development of science and its practical application in the operating processes serve the basis for development of innovative ventures, which is possible due to cooperation with science and technology parks. The efficiency of the development of innovative activity of enterprises through cooperation with science and technology parks is proved by global experience of the leading European countries.

In the meantime, the tendency for efficient use of resources and introduction of socially responsible business concept has been observed in the international community. The above tendencies have been implemented through adoption of the concept for sustainable development of the states. The concept of sustainable development is more and more affecting the development of economic entities throughout the world. However, if at macro level such concept may be implemented through normative acts and reforms, then its implementation at the level of enterprises requires significant changes, including intensification of innovative activity of enterprises and science and technology parks as one of the main tools of implementation of the principles of sustainable development.

The introduction of innovations by manufacturing enterprises was studied by the leading world and domestic scholars. The weighty contribution to the theory of innovations and its connection with marketing theory was made by such foreign scientists as P. Drucker, N. Mansfield, P. Santoro, B. Twiss, and J. Schumpeter [9, 15]. The innovative development of the enterprises was also studied by I. T. Balabando, S. V. Valdai, S. V. Voiko, V. V. Dergachova, M. Z. Zhurovsky, P. N. Zavlin, D. M. Stechenko, R. A. Fatkhudinov and others [5, 8, 10, 11, 13]. The development of science and technology parks in Ukraine was highlighted in the works of S. M. Illiašenko, O. V. Kamianska, N. F. Pavlenko, O. S. Teletov and others.

However, theoretical foundations of the market-oriented innovative development of enterprises of science and technology park require further development of theory due to the limitations of the functioning models of science and technology parks in Ukraine, which induces the relevance of further theoretical developments in this direction.

The purpose of the article is to study the theoretical and methodological grounds of operation and innovative development of enterprises within science and technology park.

On the basis of generalized scientific works, the economic nature of the categories of theory of innovations was analysed, and three basic categories which do not have a specific origin of innovation, there have been defined three approaches to its interpretation: 1) object approach – innovation is seen as a certain result in the form of new technology, new product, method, etc.; 2) process approach – innovation is seen as a process of introduction of certain changes; 3) transformation approach – changes in the activity of the enterprise.

The analysis of the interrelation of such categories as novation, novelty, innovation, innovative activity, innovation process gave the possibility to define that novelty is an embedded novation that in the process of market diffusion becomes innovation, and novation is a new method, goods, raw materials, technology, etc. The gradual transition from novation to innovation is an innovation process. In turn, the innovative activity is a broader category and covers, in addition to the innovation process, search for novations, their adaptation or development, procedure of introduction, etc. The approaches to defining the innovative activity were analysed [5, 8, 10, 15]. Thus, it was determined that the innovative activity depends on the economic entity. Based on the results of the research, it is offered to define the "innovative activity of science and technology park" as an arrangement of the activity of enterprises, research institutions and other participants of science and technology park aimed at ensuring the teach by innovative products of the result suitable for use by manufacturing enterprises in order to create sustainable competitive advantages through coordination of economic interests of all participants of science and technology park. Accordingly, the relation between the innovative activity of the enterprise, activity of science and technology parks, and implementation of the concept of the sustainable development at enterprises and science and technology parks is to achieve the same effects for economic entities.
nology park and science and technology park as an independent economic entity, the groups of social, financial and economic, and environmental indices were identified. The marketing problematic as to implementation of the concept of sustainable development is grounded, and the introduction of the group of marketing indices in the course of analysis of the correspondence of activity of the science and technology parks and enterprises to the concept of sustainable development was offered. The indices for assessment of innovation according to the concept of sustainable development divided into four groups (financial and economic, environmental, social, and marketing) were defined for each group of indices (Table 1).

Table 1
Indices for Innovation Assessment

<table>
<thead>
<tr>
<th>Group of Indices</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial and economic</td>
<td>Corporate profit</td>
</tr>
<tr>
<td></td>
<td>Operating profitability</td>
</tr>
<tr>
<td></td>
<td>Capitalization through tangible</td>
</tr>
<tr>
<td></td>
<td>and intangible assets</td>
</tr>
<tr>
<td>Ecological</td>
<td>Energy intensity of production</td>
</tr>
<tr>
<td></td>
<td>Resource intensity of production</td>
</tr>
<tr>
<td></td>
<td>Level of equipment depreciation</td>
</tr>
<tr>
<td></td>
<td>Level of toxic industrial waste</td>
</tr>
<tr>
<td>Social</td>
<td>Additional working places</td>
</tr>
<tr>
<td></td>
<td>Salary level</td>
</tr>
<tr>
<td></td>
<td>Social package</td>
</tr>
<tr>
<td></td>
<td>Safety of working places</td>
</tr>
<tr>
<td></td>
<td>Education and qualification of</td>
</tr>
<tr>
<td></td>
<td>personnel</td>
</tr>
<tr>
<td>Marketing</td>
<td>Competitive capacity of enterprise</td>
</tr>
<tr>
<td></td>
<td>Level of supply</td>
</tr>
<tr>
<td></td>
<td>Development of new trading outlets</td>
</tr>
<tr>
<td></td>
<td>Raising of awareness</td>
</tr>
<tr>
<td></td>
<td>Level of consumer satisfaction</td>
</tr>
</tbody>
</table>

Source: made by author based on reference list [10, p. 31; 6, p. 23; 14]

These indicators serve the basis for decision-taking on compliance of innovations with the concept of sustainable development, as well as the basis for their assessment as to compliance with prospects of implementation at the manufacturing enterprises.

On the basis of the analysis of activity of the science and technology parks and innovative activity of the enterprises the tendency to intensification of the innovative activity in order to create competitive advantages in the market is outlined. However, the tasks faced by the enterprises are not solved in full due to lack of infrastructure for introduction of innovations. In addition, the organizational structure of science and technology parks existing in Ukraine prevents from using a significant amount of the benefits from joint development due to imperfections in the organizational structure. Thus, it is determined that the activity of the enterprises of science and technology park should be based on functional and structural approach to creating the science and technology park, as well as market basis of attraction of enterprises, and should include assessment of prospects of introduction of the innovations. This enables a more efficient use of internal resources of the enterprise, reduction of the innovation cycle, release of additional resources for innovation activity of enterprises in order to create sustainable competitive advantages.

One of the most important components of the organizational structure of the developed model of science and technology park is the formation of information flows in order to spread information about solutions of science and technology park and effects from their introduction. The proposed structure of science and technology park allows to solve the following problems of operation of science and technology parks in Ukraine: fostering formation of small and medium-sized innovation enterprises; intensification of the innovation activity of the enterprises with no significant resources attracted, as well as the possibility of formation of additional competitive advantages; increase in opportunities of financing of innovative solutions on account of concentration of the resources of enterprises and research institutions; adjustment of the network of interactions among research institutions, manufacturing enterprises, and science and technology parks; development of innovative technologies for target consumer.

To implement the developed model, the following procedure of operation of enterprises of science and technology parks is offered (Pic. 1).

This procedure involves several stages. At the initial, preliminary, stage, the identification and analysis of innovative solutions available at research institutions, which forms the requirements to their potential customers, are conducted. At the second, analytical, stage, the potential consumers of innovative solutions and compliance with consumer needs are analysed. At the third, implementation, stage, the innovations that can be introduced at the enterprise in accordance with the sustainable development concept that is the basis for formation of sustainable competitive advantages of the enterprise are selected. At the final, supervisory stage, the efficiency of operation of science and technology park and enterprises according to four groups of indices (financial and economic, social, environmental, and marketing ones) is assessed.

In the course of innovative development of enterprises of science and technology parks and with the purpose to enhance their innovative activity, it is advisable to act in two directions as follows: 1) to identify the ways to raise the efficiency of enterprise based on groups of indices of sustainable development within the basic scope of corporate activity; 2) to evaluate the portfolio of business lines of enterprises based on groups of indices of sustainable development (Pic. 2).

The first block of tasks is offered to be discharged through the following stages: 1) preliminary, 2) analytical, and 3) implementation ones. At the preliminary stage, the activity of the enterprise is analysed; and the potential areas of introduction of innovation and collection of information to assess innovation are identified. For this purpose, the initial limitations for innovations are outlined. They include
Stages: Preliminary Stage
Purpose of Stage: Discovery of innovative solutions of R&D block
Details of Stage:
- Formation of innovations flow of research institutions
- Audit of innovations: preliminary expert assessment of prospects
- Defining the initial resource restrictions: expert's assessment
Outcome: Requirements to potential consumers of innovations

Stages: Analytical Stage
Purpose of Stage: Discovery of potential consumers of innovations and their selection
Details of Stage:
- Formation of list of potential customers
- Defining the relevance with resource restrictions
- Expert assessment based on available resources
- Analysis of demand level: in-depth interview
Outcome: List of potential consumers

Stages: Implementation Stage
Purpose of Stage: Selection of innovations of science and technology park for enterprise
Details of Stage:
- Audit of enterprise to define the ways to raise its operation efficiency
- Selection of innovations based on criteria of sustainable development
- Phased introduction of innovations at enterprise on a priority basis
Outcome: Introduction of innovations by enterprises

Stages: Supervisory Stage
Purpose of Stage: Calculation of efficiency of operation of science and technology park
Details of Stage:
- Calculation of effects
Outcome: Efficiency of operation of science and technology park

Calculation of effects

<table>
<thead>
<tr>
<th>Economic</th>
<th>Social</th>
<th>Ecological</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profitable science and technology park</td>
<td>Corporate profit</td>
<td>Additional places</td>
<td>Balanced portfolio</td>
</tr>
<tr>
<td>Profitability of enterprise</td>
<td>Profitability of enterprise</td>
<td>Development of social infrastructure</td>
<td>Balanced portfolio</td>
</tr>
<tr>
<td>Additional working places</td>
<td>Development of social infrastructure</td>
<td>Efficient use of resources</td>
<td>Balanced portfolio</td>
</tr>
<tr>
<td>Development of social infrastructure</td>
<td>Efficient use of resources</td>
<td>Reduction of air emissions</td>
<td>Balanced portfolio</td>
</tr>
<tr>
<td>Efficient use of resources</td>
<td>Reduction of air emissions</td>
<td>Increased competitiveness</td>
<td>Balanced portfolio</td>
</tr>
<tr>
<td>Reduction of air emissions</td>
<td>Increased competitiveness</td>
<td>Increase in sales of goods and services</td>
<td>Balanced portfolio</td>
</tr>
<tr>
<td>Increased competitiveness</td>
<td>Increase in sales of goods and services</td>
<td>Balanced portfolio</td>
<td></td>
</tr>
</tbody>
</table>

Pic. 1. Stages of Operation of Enterprises of Science and Technology Parks

Source: developed by author [1 – 4; 7; 12; 13, p. 206].
own financial resources; attracted financial resources; legislative restrictions; raw materials; intellectual resources; engineering and manufacturing resources; and strategic goals of the enterprise. With respect to raw materials, intellectual, and engineering and manufacturing restrictions, the correlation with financial resources of the enterprise is inherent. Thus, in case of additional funding, the initial restriction will be available financial resources of the enterprise.

To define the “bottleneck” of the enterprise, it is offered to make an analysis based on the model of the existing organizational structure with all kinds of flows, namely, trade, information, finances, raw materials, etc. Based on such analysis, the potential areas where innovations are to be introduced, as well as the innovations which may be introduced, are outlined. The analysis is conducted for the following types of innovations: trade, technological, raw materials, market, and organizational ones. In the course of analysis, the list of resources required for their introduction at the enterprise is made. After that, the innovations are filtered based on resource and legislative restrictions, and the final list of innovations is made. At the analytical stage, the innovations are assessed on the basis of indices of sustainable development, and the innovations potentially to be introduced by manufacturing enterprises are outlined. The method of analytic hierarchy process for assessment of innovations based on indices of sustainable development (which include four groups of indices, namely, financial and economic, environmental, social, and marketing ones, each having its weight value) is offered to be applied. Weight values are defined by internal and external experts to ensure unbiased treatment by the managers of the enterprise. To calculate an integral value for every innovation the following formula is used:

\[ R_n = \sum_{i=1}^{m} w_i \cdot q_j \cdot C_{ij}, \]

where \( R_n \) – integral scoring of the \( n \)-th innovation based on indices of sustainable development;
\( N \) – index number of innovation;
\( W_i \) – weight value of the first-level index of the hierarchy;
\( q_j \) – weight value of the second-level index of the hierarchy;
\( C_{ij} \) – innovation scoring under the \( ij \)-th index.

Based on the assessment, each innovation is scored, and the most perspective innovations to be introduced at the enterprise are defined. The obtained data serve the basis for multifactor model of introduction of innovations. To reach a compromise between limited resources of the enterprise and identified innovations which require the resources for introduction, the innovations are ranked, and the relevant financial resources for each innovation necessary for its introduction are determined. As a result of applying the procedure of innovative development, the fullest range of innovations that may be introduced at the enterprise is defined.

**CONCLUSIONS**

On the basis of study of features of the innovative activity of national enterprises, the conceptual framework for operation of the enterprises of science and technology park is formed. It is based on functional and structural approach to the creation of science and technology park, as well as

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1. Defining the Ways of Raising the Efficiency of Operation of the Enterprise Based on Groups of Indices of Sustainable Development within the Existing Business Line(s) of the Enterprise

<table>
<thead>
<tr>
<th>Preliminary Stage</th>
<th>Analytical Stage</th>
<th>Implementation Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>analysis of the activity of the enterprise;</td>
<td>assessment of innovations based on indices of sustainable development;</td>
<td>planning of introduction of innovations by the enterprise;</td>
</tr>
<tr>
<td>defining the potential areas of introduction of innovations;</td>
<td>defining the perspective innovations to be introduced</td>
<td>introduction of innovations by the enterprise</td>
</tr>
<tr>
<td>data collection for assessment of innovations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Assessment of Portfolio of Business Lines of Enterprises based on Groups of Indices of Sustainable Development

<table>
<thead>
<tr>
<th>Analytical Stage</th>
<th>Implementation Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>assessment of portfolio of business lines of enterprises based on criteria of sustainable development;</td>
<td>search and introduction of new business lines or refusal from their introduction;</td>
</tr>
<tr>
<td>decision-making with respect to advisability of introduction of new types of business lines</td>
<td></td>
</tr>
</tbody>
</table>

Pic. 2. Stages of Innovative Development of Enterprises within Science and Technology Park [4]
market mechanism for attraction of enterprises which involves identifying of the internal reserves of the enterprise, and includes assessment of prospects of introduction of innovations based on sustainable development. The introduction of the developed procedure of operation of enterprises of science and technology park comprises four stages: 1) analysis of innovative solutions of science and technology park, 2) identification of potential consumers of innovations, 3) selection of innovations of science and technology park for the enterprise based on criteria of sustainable development, and 4) assessment of the efficiency of operation of science and technology park.

Fostering the innovative activity of enterprises is envisaged on the basis of the gradual innovative development of enterprises within the science and technology park. At the first stage, the innovations which may be introduced at the enterprise within the existing types of activity are offered to be assessed. At the second stage, the business as a whole based on indices of sustainable development is offered to be assessed. This gives the possibility to diversify the activity of the enterprise in case the main type of its activity is not in line with the indices of sustainable development, as well as to ensure sustainable competitive advantages for all types of activity, and to foster the innovative activity of enterprises without significant additional resources.

LITERATURE


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