

FORMATION OF THE MECHANISM OF COMMERCIALIZATION OF INTELLECTUAL TECHNOLOGIES ON THE BASIS OF THE FUNCTIONAL APPROACH

Pererva P., Maslak M., Kobieliava A.

National Technical University «Kharkiv Polytechnic Institute», Ukraine

DOI: 10.31891/monograph/2021-10-64

1. Introduction

Today innovative activity as the most important component of scientific and technological progress is extremely important direction of development of industrial production in any country. It is activity that allows for the constant renewal of industrial production based on the latest achievements of scientific and technological progress.

Successful commercialization of the results of intellectual work is the most important component of the innovative development of the economy in any country in the world. Business organizers are always faced with the question: how to create a rational scheme for making innovative products and their effective commercialization. The main goal of such a scheme is leading market positions and achieving the greatest possible commercial result from its production and commercial activities. Each country in the development and commercialization of innovations has its own characteristics, and these features are most show in countries that are not part of the European Union.

The results of the research carried out make it possible to identify a certain pattern, which manifests itself in the timing of fundamental and applied scientific research. Most often, fundamental research is ahead of applied research, which affects the terms of commercialization, which can be carried out only some time after the completion of fundamental research. In some cases, society even exerts an inhibitory effect on the process of carrying out fundamental scientific developments to create practical opportunities for the application of fundamental scientific developments.

At present, the commercialization (transfer) of the results of intellectual work is presented in the world as an independent branch of the economy. According to expert estimates, the annual volume of the world market for intelligent products is estimated at 6 trillion USD, the annual growth rates of this market exceed 10...12%. The results of effective commercialization of innovations

have allowed many countries of the world to take leading positions in the market of intelligent technologies. For example, the share of the international market for high technology products is 35% for the United States, 29% for Japan, 7% for China, while the share of Ukraine and Poland does not exceed 0,1%, for the Russian Federation – 0,5% [1, 2, 4].

2. Analysis of the existing practice of commercialization of intelligent technologies

To achieve their own effective indicators of innovation, the developed countries of the world are pursuing an active innovation policy. In different countries, the commercialization process has its own characteristic features, which are expressed mainly by different institutional conditions.

It seems necessary to consider foreign experience in the creation and use of mechanisms for the commercialization of intelligent technologies.

The most popular in the practice of innovation are such programs as "The Small Business Innovation Research - SBIR" and "The Small Business Technology Transfer Program - STTR", developed 40 years ago in the United States. The SBIR program serves to attract innovative ideas from small businesses to solve scientific and technical problems on the topics of the largest federal ministries and national agencies in the United States. The STTR program enables small businesses to receive financial and technical assistance in the creation of joint ventures and / or temporary associations focused on the development of new technologies from the initial idea to their full implementation [2, 4].

Similar programs are used in other countries as well. For example, in Japan, the SBIR program focuses on attracting financial resources and technical capabilities of the state in the form of grants, loan guarantees, soft loans, and outsourcing services. The purpose of these programs is to help start-ups of industrial enterprises that involve the development of intelligent technologies for their subsequent commercialization [2, 5]. In Canada, the analogue of the SBIR and STTR programs is the Industrial Research Assistance Program - IRAP. In Austria - "Cooperation and Innovation - COIN".

Less effective smart technology commercialization programs are being used in Sweden - The Innovation Bridge, which specializes in supporting the commercialization of research results; in Finland - The Center of Expertise Program - OSKE, which is designed to organize innovation management processes

in the regions of the country; in France - the “Agence Nationale de Valorisation de la Recherche - ANVAR” was created to provide assistance and financial support for innovative activities in the French industry, mainly in the small and medium-sized business sector; in Switzerland, opened the "National Centers of Competence in Research - NCCR" [2, 6].

National innovation programs that are used in the Republic of China are intended to a greater extent not for the development of processes and mechanisms for the commercialization of the results of innovative activities, but to a greater extent support the rapid innovative development of the entire country. For example, the 863 innovation program contributes to the development of national scientific and technological potential in the most important areas of scientific and technological progress. In China, these include space, nuclear and non-traditional energy, etc., which ensure stable growth of the entire national economy in the medium term. The Torch program is aimed at introducing advanced foreign and domestic developments into production. The Spark program is aimed at the development of agricultural enterprises and agriculture based on the use of scientific and technological achievements.

In European countries, private structures, which are intermediaries between the creators and consumers of new intelligent technologies, have also become somewhat widespread. These include various centers for the transfer and commercialization of innovations, including those created within the framework of research institutions.

An important mechanism for the effective commercialization of intelligent technologies is various methods of state support and stimulation of innovation. In the developed countries of the world, the following tools are effectively used to stimulate the transfer and commercialization of innovations [3, 8]:

a) direct financial support - subsidies, loans, loans on concessional terms without payment of interest and gratuitous. Their volume reaches 50% of the total expenses of developers of intelligent technologies (Germany, Great Britain, India, Denmark, China, USA, Norway, Sweden, France);

b) reduction of state duties for independent (individual) inventors, granting them tax incentives, payment deferrals or complete exemption from payment (Austria, Germany, Great Britain, India, Greece, Spain, Ireland, China, Poland, Norway, France, USA, Japan);

c) permission for employees of state research institutes and organizations to take part in commercial activities for the commercialization (implementation) of intellectual developments, as well as to work part-time, to own shares in an enterprise, to take part in the management of enterprises (Austria, Great Britain, Denmark, China, France, Greece);

d) simplification of taxation for organizations and enterprises that work in the field of commercialization of innovations: preferential taxation of universities, exemption from taxation of research and development costs (UK, USA, China, India, Japan);

e) legislative support for the protection and protection of intellectual property and copyrights, the creation of an economic and legal infrastructure for their insurance and economic support (Germany, Great Britain, Denmark, USA, India, China, France, Norway, Sweden);

f) creation and state support of a wide network of business incubators, science parks, technological development zones (Japan, USA, Denmark, Germany, China, India, Sweden);

g) methodological and informational support of the subjects of the innovation sphere: the formation of information resources and the creation of direct access to them, the simplification of the procedure for obtaining grants, the formation of special arrays of information (databanks) about patented inventions, etc. (UK, USA, Germany, European Union, China, Sweden).

Thus, for the effective market commercialization of intelligent technologies, a sufficiently developed complex of various organizational, economic and stimulating mechanisms is required. The study of foreign experience in the commercialization of innovations allows us to generalize examples of balanced state regulation of the sphere of innovation activity both through its direct participation in innovation activities and using methods and techniques of indirect support, including the creation, development and support of innovation infrastructure.

Some measures to support and improve the conditions for conducting innovative activities have also been implemented and implemented in Ukraine. Among them are tax and in-kind preferences; stimulation of contract research; state support for innovative activities of small and medium-sized enterprises; stimulation of researchers creating scientific results, etc. Unfortunately, most of

these mechanisms have not yet achieved the expected results. For these measures to be fully implemented, a long period of time is required. For the innovation sphere of Ukraine, such a low level of financing of the scientific and technical sphere threatens to catastrophically lag not only in the sphere of innovation, but also in the socio-economic development of the country.

Therefore, there is an urgent need for the development and implementation of new, scientifically grounded mechanisms for the commercialization of intelligent technologies, which, with a minimum amount of funding, could provide the necessary efficiency in their practical use.

3. Research results

There are various definitions of the term "commercialization", which, despite the existing differences, they all have one thing in common - commercialization is always considered as a sequence of certain actions. The successful activity of the developer of innovations in this area presupposes the timely selection of the most effective commercialization project. This allows him to rationally use (distribute) resources (primarily financial), as well as predict possible positive or negative changes in the target market for a given technology. With a functional approach to assessing commercial prospects for commercialization, the main task of an intellectual technology developer is to substantiate the form or scope of technology commercialization. The practice of commercialization has developed three main forms of using the results of innovative activities: internal commercialization (the use of technology only in its production), full sale of rights to the technology to another consumer (transfer of the right to use the technology on the basis of an exclusive license, which excludes the possibility of its use by the licensor in the area designated by the license) and the assignment of only a part of the exclusive rights to the technology (on the basis of a single or non-exclusive license, which does not exclude the possibility of its use by the licensor in the area indicated by the license). A detailed analysis of these forms of technology commercialization made it possible to identify and substantiate their advantages and disadvantages (Table 1).

The developer of intelligent technology can receive the greatest income only in the case of independent use of this development at his enterprise. In this case, there are real opportunities to create a completely new or significant modernization of existing production using this technology. However, this is the costliest method

of commercialization (creation and support of production processes, additional equipment, retraining of personnel, a new marketing program and advertising campaign, market revision of a new product, etc.). The technology developer does not always have sufficient resource capabilities for his own production, so he is forced to use other functional methods of commercialization.

Table 1. Advantages and disadvantages of functional forms of commercialization of intelligent technologies

Functional form of technology commercialization	Basis for use	Advantages	Disadvantages
Full transfer of exclusive rights to technology	Top management decision or based on intrapreneurship	<ul style="list-style-type: none"> - low costs; - a project with little risk of failure; - fast payback; - high level of profitability 	<ul style="list-style-type: none"> - the level of income is limited by the license; - strengthening the positions of potential competitors; - weakening of their competitive advantages
Partial transfer of exclusive rights to technology	Single or non-exclusive license	<ul style="list-style-type: none"> - minimal risks; - low costs; - short payback period of the project; - opportunities for the development of new markets; - additional funds from the licensee; - development of the brand policy of the developer 	<ul style="list-style-type: none"> - the minimum level of income from innovation; - high risk of counterfeit products; - the risk of unauthorized violation of exclusive rights
Use in own production	Exclusive license	<ul style="list-style-type: none"> - strengthening of competitive advantages; - the opportunity to get a very high income; - own control of production and sales; - opportunities for the development of their production; - no risks of violation of exclusive rights 	<ul style="list-style-type: none"> - high risks of commercial failure; - long investment payback period; - great need for financial resources; - possible lack of the necessary facilities, equipment and specialists

The transfer of a part of exclusive rights, as a rule, is possible only to a potential competitor. This kind of operation provides the technology developer with a relatively low income, because the developer will receive only a part of the potential profit that will be received by the licensee.

The complete transfer of exclusive rights to intellectual technology is characterized by the lowest cost to the developer. At the same time, the developer could receive a fairly large income immediately (with a lump-sum payment for a license) or a stable income over a certain period of time (when using royalties). But it should be borne in mind that the developer completely refuses scientific and production activities in this area, which is usually stipulated in the text of the exclusive license.

The initial assumptions, which are proposed to be used as the basis for a functional approach to the commercialization of intelligent technologies, include a set of actions that involve the transformation of scientific research results into innovations. Innovations are formalized in the form of new goods or services, goods that are displayed in a market environment that combines the processes of material production, commercialization and the use of the results of intellectual labor (Fig. 1).

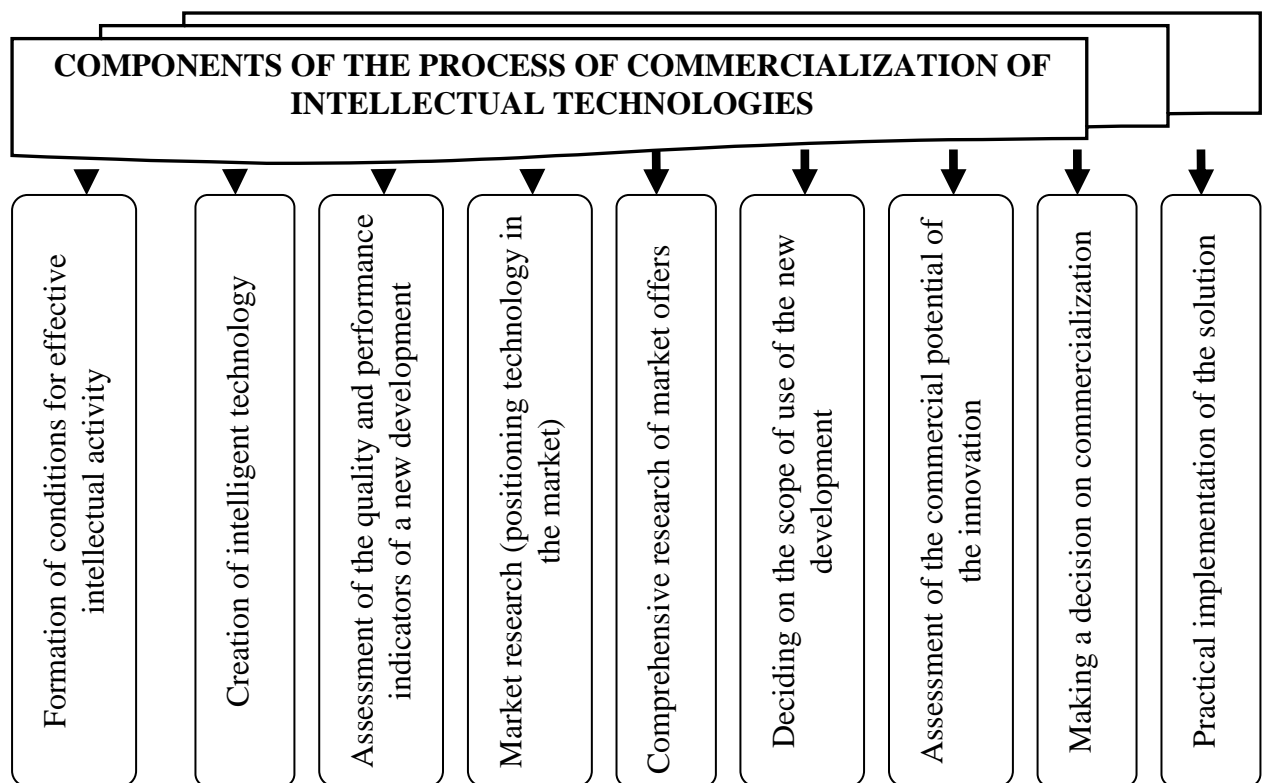


Fig. 1. Organizational components of the commercialization of intelligent technologies

The presentation of the organizational process of the commercialization of intelligent technologies in the form of a sequence of stages in the transformation of an innovative idea into a scientific product, brought to its consumer, provides a real opportunity to stage-by-stage analysis of the results of the innovation process,

to assess the amount of required resource (primarily financial) support, to choose the most effective commercialization scheme and financing methods. The approach to the commercialization of intelligent technologies as an investment project provides all the possibilities for accounting for financial risks, which allows taking certain measures to minimize financial losses.

During the process of commercializing smart technologies, income can be obtained from all commercial offers that:

- are directly related to the use of intelligent technologies;
- reflect the performance of research work to bring the technology to the level of market application;
- imply the sale of licenses for the use of technologies to third parties;
- create prerequisites for the practical implementation by developers of start-up companies or joint ventures with strategic partners for their own production of products, using the developed technologies.

The results of the research allow us to distinguish three functional groups of key participants in the process of commercialization of intellectual technologies: authors (copyright holders) of intellectual technologies; investors (buyers, consumers) of intelligent technologies; subjects of the infrastructure of the market of intelligent technologies. Each of these groups has an independent meaning and performs its main tasks within the framework of the tasks facing it [7]. However, each of these groups is in close relationship with other groups, as it is also subordinated to the successful solution of the ultimate strategic task - the effective commercialization of intelligent technologies.

The functional relationships between the three key groups - participants in the commercialization of intelligent technologies are shown in Fig. 2.

It seems appropriate to consider in more detail the group of copyright holders, which is the most important and intellectually strongest part of the technology commercialization mechanism.

The group of developers (authors) of intelligent technologies is most actively represented by several, to a certain extent, independent subgroups. The first subgroup is proposed to include research organizations and institutions that have achieved international funding (grants or foreign direct investment). These are successful representatives of intelligent technology developers, who, as a rule, account for the largest amount of new innovative technologies and know-how.

Note that in this case, the process of commercialization of innovations is carried out not by the institution itself, but by its owner (the customer of the innovative development). The state, a large firm (corporation), or a private investor can act as the owner (customer), which is usually secured either by legal means (registration of ownership or the conclusion of a certain agreement), or by transferring the results of scientific research to the customer (funding party) in the form of scientific reports.

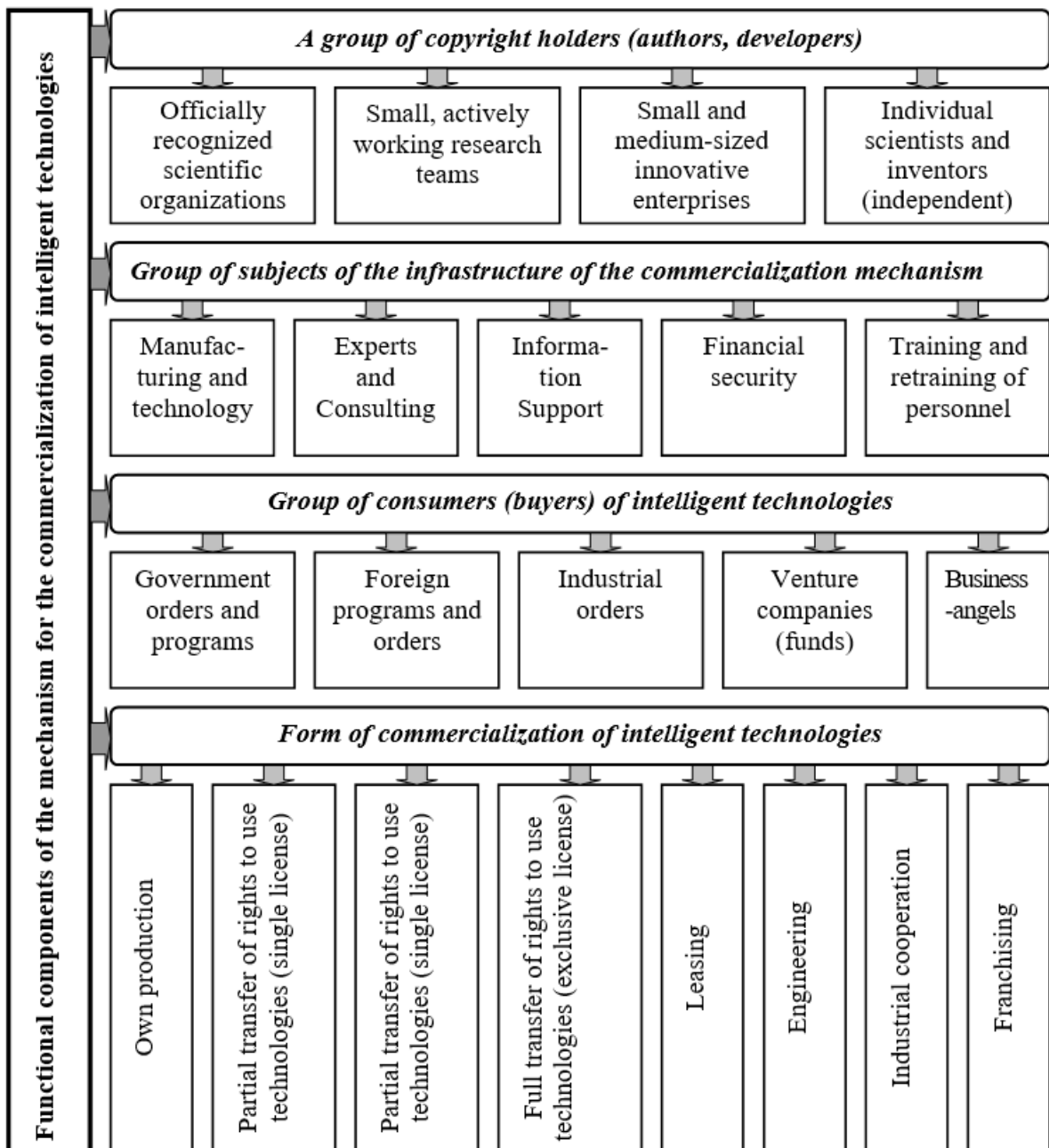


Fig. 2. Components of the mechanism for the commercialization of intelligent technologies based on the functional approach

The second subgroup of technology developers should also include research organizations (teams), which experience serious limitations in the resources

necessary for successful scientific work. Funding is provided in the form of small grants, scientific activity and its effectiveness largely depends on the enthusiasm of scientists. This subgroup of developers, as a rule, owns a large number of intelligent technologies, which are often not brought to the final stage and are not prepared for the commercialization process. At the same time, in our opinion, the commercial potential of this group of developers is the greatest.

The third subgroup includes small innovative enterprises that already have some experience in the commercialization of their own and borrowed scientific developments and most often specialize in small segments of the target market. This subgroup most often needs to expand its production and commercial activities, it has an urgent need for additional working capital. To this end, representatives of this subgroup are looking for strategic partners and investors, pay great attention to the development of their enterprises and expanding the scope of innovative projects.

The fourth subgroup is proposed to include scientists and inventors who, for certain reasons, are not members of scientific teams and do not actively participate in the work of organized teams. They are very limited in resources, often own a large number of patents, but in most cases they do not have the opportunity to bring their developments to market use [7].

4. Conclusion.

A detailed study of the components of the mechanism of commercialization of intelligent technologies based on a functional approach made it possible to formulate the following areas of their close interaction:

- it is necessary to improve the legal framework for financing innovations, to develop simplified mechanisms for financing the creative activities of small research teams that carry out effective innovative activities;

- an urgent task is the formation of a mechanism for reinvesting income from commercialization in new intellectual developments (projects);

- the participation of the state in the formation of cluster associations, their use as a base platform for the commercialization of technologies is very important;

- it is necessary to legalize the creation of infrastructure for the development of public-private partnerships in the field of commercialization of innovations;

- an important direction is the formation of a system of incentives for participants in the mechanism of commercialization of technologies that have a dual purpose.

Thus, a functional approach to the commercialization of intelligent technologies is designed to create favorable conditions using a system of material and moral incentives for all participants in the commercialization of intelligent technologies.

References

1. Tikhonov N.A. (2011) Foreign experience of commercialization and bringing innovative products to the market // Innovative aspects of socio-economic development of the region: collection of materials of the III Annual scientific conference of postgraduate students of KIUES - Korolev: KIUES. P. 39-45.
2. Bondarenko V.A. Foreign experience of state support for innovative small and medium enterprises // Portal for information support of foreign economic activity. URL: http://www.vneshmarket.ru/content/document_r_%7B53C5CE2B-F73C-4DE2-9366-31DC6A60F4A8%7D.html
3. Kalyatin V.O., Naumov V.B., Nikiforova T.S. (2011) The experience of Europe, the United States and India in the field of state support for innovation // Russian legal journal. No. 1 (76). URL: <http://www.ruzh.org/?Q=node/4&kodart=2421>
4. Republican Center for Technology Transfer. URL: <http://ictt.by>.
5. Ivanov V.V. (2016) Commercialization of the results of scientific and technical activities: European experience, possible lessons for Russia. Moscow: TSIPRAN RAN. 264 p.
6. Tikhonov N.A. (2018) Development of a mechanism for bringing innovative products to the market. Moscow: Center. 24s. URL: <https://www.dissercat.com/content/razvitie-mekhanizma-vyvedeniya-innovatsionnykh-produktov-na-rynok>
7. Makaruk O.E. (2017) The mechanism of commercialization of the results of innovative activities // Bulletin of the Brest State Technical University. No. 3. S.101-104. URL: https://elibrary.ru/download/elibrary_37381815_55351235.pdf
8. Technology transfer : monograph (2012) / ed.: P.G.Pererva, G.Kocziszky. – Kharkiv : NTU "KhPI" ; Miskolc : University of Miskolc. 599 p. URL: <http://repository.kpi.kharkov.ua/handle/KhPI-Press/39647>
9. Compliance program (2019) / ed.: P. G. Pererva, G.Kocziszky, M. Veres Somosi. Kharkov; Miskolc : NTU "KhPI". 689 p. URL: <http://repository.kpi.kharkov.ua/handle/KhPI-Press/41505>