

TECHNOLOGY TRANSFER AS A MECHANISM OF STRATEGIC INNOVATIVE DEVELOPMENT OF ENTERPRISES

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ABSTRACT

To conduct a comprehensive study of the impact of technology transfer processes on the innovative activity of enterprises methodological provisions were proposed, which include the following main stages: assessment of the level of competitiveness of enterprise products and its compliance with modern technological developments; analysis of the enterprise's needs for technology transfer; analysis of transfer resources (financial resources, human resources); assessment of internal possibilities of development of the transfer system; analysis of activation of technology transfer process; cost estimation of introduction of a new technological product. Application of the proposed methodology will allow systematically investigate the processes of technological development of the enterprise and will become the basis for introduction of integrated management of transfer processes. Enterprises need to look for efficient technologies; without finding relevant options within the country, they often have to turn to foreign developers. The problem of this phenomenon lies with unsatisfactory system of technology exchange between participants of the innovation process, which leads to a widening gap between science and production and consequently leads to reducing competitiveness of national products, worsens economic situation in the country.

Keywords: Innovative Development, Technology Transfer, Competition, Strategic Management, Business Environment.

JEL Classifications: M21

INTRODUCTION

Under conditions of deep systemic crisis, constant changes and fierce competition among economic entities, the main condition for ensuring competitiveness on the market is their ability to innovate, including due to technology transfer, whose role is important for enterprises that are lagging behind in technological development.

Given the growing importance of the technological component of economic growth, the issue of systematic introduction of advanced technologies, the possession of which provides the enterprise with long-term competitive advantages, becomes especially important. Accordingly, in the context of ensuring technological development, it is important both to develop the scientific capacity to create technology by own efforts and to actively involve technology developed by other enterprises and organizations through transfer.

On the one hand, enterprises have a limited material and technical base to carry out independent research, and on the other hand, professional research institutions, without receiving adequate public funding, need to intensify cooperation with the real sector of economy. It is building of relationship between science and business that will facilitate transfer of technologies

and their approbation, will ensure the innovative development of enterprises on a continuous basis. Vast majority of enterprises require revitalization of innovation, and the real lever of these processes at this stage should be technology transfer. Accordingly, the problem presented is relevant and needs to be considered from the standpoint of taking advantage of all the benefits and opportunities.

The purpose of the article is to study the theory, methodology and practice of technology transfer management in the context of substantiation the components of the mechanism of activation of enterprise participation in these processes, to determine the criteria for the efficiency of the studied processes and to substantiate proposals for implementation of technology transfer stages in the process of innovative development of enterprises.

REVIEW OF PREVIOUS STUDIES

The issues of technology transfer have been reflected in the scientific works of experts. An important contribution to the study of technology transfer problems was made by scientists Drobyazko et al. (2019a & b), Crager (2018), Skrypnyk et al. (2019) who considered the peculiarities of contractual relations between participants and the emergence of obligations and rights regarding the transferred technology.

Technology transfer as an activity was considered by Hilorme et al. (2019a & b), Mikkonen et al. (2018), who emphasized that this is a particularly complex form of communication and interaction that involves application of knowledge, its purposeful use and requires coordinated actions of two or more individuals or functional units separated by structural, cultural and organizational barriers.

Technology transfer from the standpoint of communication and interaction is presented in the works of Carayannis et al. (2017). The authors note that the knowledge, experience, industrial property acquired through fundamental and applied research is freely disseminated, transmitted through provision of scientific and technical services, or purchased by enterprises for implementation as a product or process.

Based on the process approach used in the works of Castillo et al. (2018), transfer means transformation of a new idea, development or technology into a commercial product supported by consumer demand.

Despite a rather comprehensive study of this problem, the activity of transfer use remains low, which determines the need to develop mechanisms for implementing the benefits of technology transfer to the practical sphere at enterprises.

METHODOLOGY

Research methods used: quantitative and qualitative methods, analytical and comparative methods, methods of statistical information processing, analysis and synthesis, economic and mathematical modeling, etc.

RESULTS AND DISCUSSIONS

In today's world, technology transfer is an instrument of innovation process. Developed countries, using technology transfer, seek to change their positions and structure of their presence on the international market, thereby influencing the structure of production of goods and services of the national economic sector.

Presently strategic cooperation of financial and industrial sphere of the enterprise is no longer sufficient to ensure its competitiveness on the world market and integration into the world economic space.

In our opinion, intellectual capital as a factor of technological development in the process of adaptation of the enterprise to changes caused by scientific and technological progress can be acquired through implementation of a number of strategic decisions: improving the skills of employees through exchange of experience and / or personnel internship in the leading international companies (courses in world business schools), continuous analysis of the company's existing potential, continuous monitoring of market trends, application of international advanced technologies and know-how in their work. That is why it would be advisable to pay more attention to international technology transfer, as an element that maximizes the return due to its implementation and provides economic entities with a number of strategic options: development of the internal market, development of emerging industries, adaptation and transfer of achievements of developed countries and entry into transnational infrastructure.

Research on technology transfer processes, especially in the context of impact on innovation processes is of great importance, both at the macro and micro levels, since their activity directly in the business environment depends on the conditions created in the country. For this reason, it is advisable to carry out research on transfer processes based on the principles of multi-levelness and complexity of analysis, including in international comparison scale.

Summarizing the experience of technology leaders in stimulating technology development by national companies, one can distinguish the following main forms of integration of science and production: consulting, personnel exchange, science parks, territorial science and industrial complexes, regional agglomerations, venture business. An important function in ensuring technological development is performed by the state through budget financing of R&D, production in developing countries, provision of subsidies to various economic sectors, which contributes to structural reform of the country's economy.

In case the country has not reached the level of independent development of new technologies, it is important to ensure continuous access to new foreign technologies. Such access can be achieved through cooperation with TNC, national enterprises without foreign investment, research institutions, etc. One of the forms of technological integration of the national economy is the establishment of branches, joint ventures, alliances.

National economy needs to import new technology in any form (R&D, equipment, patents, etc.), but it must learn to use these “*inputs*” effectively to transform it into its own technological capabilities. Use of new technologies is not a simple or automatic process. The process of importing technology should lead to a conscious construction of the “*technological capability*” of the country. At this a big problem of harmonization may arise: use of new technologies requires development of new education system, infrastructure, and fundamentally new characteristics of the internal market demand.

The efficiency of enterprise transfer process management depends on the level of information support, which is based on a comprehensive analysis of technology transfer. For this reason, it is necessary: firstly, to determine the basic principles of evaluation of technology transfer of the enterprise; secondly, to identify the main methodological approaches that can be used to improve monitoring of the processes under study; thirdly, to systematize indicators that taken together will allow to establish problems of providing process of technology transfer for a specific enterprise.

Therefore, to monitor the processes of technology transfer at enterprises and to assess the potential for their activation, we will use the following methodological provisions, which we have improved (Table 1).

Table 1	
IMPROVED METHODOLOGICAL PROVISIONS OF THE ANALYSIS OF THE ROLE OF TECHNOLOGY TRANSFER IN THE INNOVATIVE DEVELOPMENT OF THE ENTERPRISE	
Analysis Stage	Indicators
Assessment of the level of competitiveness of production of the enterprise and its compliance with modern technological developments	Dynamics of production output; share of the enterprise on the market; share of exported products; product prices compared to competitors' prices
Analysis of enterprise need in technology transfer	The level of depreciation of fixed assets of the enterprise; upgrading of fixed assets of the enterprise; the value of intangible assets.
Analysis of transfer resources (financial resources, human resources)	The profit margin; value of investments; value of investments in R&D; costs of personnel training for the enterprise; the number of scientific and engineering personnel.
Assessment of internal capabilities for development of the transfer system	Suitability of fixed assets; inventory turnover; coefficient of the enterprise production renewal.
Analysis of technology transfer process activation	Volume of innovative products sold; internal costs for innovation; the number of new technologies acquired; number of new technologies transferred.
Cost estimate of a new technological product introduction	Cost of research and preparatory phase for implementation of the technology transfer facility; costs of materials; payment for labor.

Source: Author's development

In general, when developing a technology transfer analysis methodology for an enterprise, the following circumstances should be taken into account:

- The process of securing transfer at an enterprise is complex and multifaceted; accordingly, the methodology of analysis should be multileveled and multifaceted;
- Not all factors in the process have quantitative indicators that can be used in the analysis;
- The process of forming a model of cause and effect dependence of processes of technology transfer of the enterprise, which will become the basis for development of a complex multilevel method of analysis, should become the basis of the methodology of the analysis.

Diagnosis of the technological basis of the enterprise involves calculation of the technological competitiveness index of the enterprise (TCI), which includes the following indicators: output of basic products per worker (thousand US dollars); volume of export per worker (thousand US dollars); share of innovative products - respectively in the output of basic products and in the volume of products exported by the enterprise. The first two indicators characterize capacity and productivity of the enterprise, the other two - the level of advancement of the production technologies used. All indicators are characterized by a high level of correlation with each other.

TCI is calculated as follows:

- 1) Value of each indicator (a factor of competitiveness) is determined:

$$j, i = \frac{x_{j,i} - \min(x_{j,i})}{\max(x_{j,i}) - \min(x_{j,i})} \quad (1)$$

Where $x_{j,i}$ describes value of j indicator for i enterprise. Enterprises are ranked from the highest value -1 to the lowest value - 0;

- 2) TCI is defined as the arithmetic mean of all indicators. To illustrate the results of calculations of the TCI, Table 2 shows the data of engineering enterprises. The choice is driven by the proximity of input and output elements of these economic systems, supply and sales markets.

Rating	Enterprise	Technological competitiveness indicators (normalized indicators)									TCI
		I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	
1	Lear	0	0.71	0	0	0.215	0	0	0.842	0	0.667
2	Vossen	0	0	0	0	0.745	0	0	0.120	0	0.096
3	Hazell	0.339	0	0	0	0	0	0	0.036	0.376	0.083

Source: Author's calculations

Note: Technological competitiveness indicators: I_1 – volume of production, units; I_2 – volume of sales, units; I_3 – fixed assets, thousand US dollars; I_4 – coefficient of the fixed assets renewal, share; I_5 – final products, thousand US dollars; I_6 – coefficient of the final products renewal, share; I_7 – intangible assets, thousand US dollars; I_8 – net sales revenue, thousand US dollars; I_9 – profit (loss), thousand US dollars.

The indicators which were used for analysis of innovative activity of the enterprises under study:

- The volume of production and sales - allows to assess the level of competitiveness of the company's products and its compliance with modern technological advances;
- The value of intangible assets, fixed assets and their renewal - allows to estimate the need of the enterprise for technology transfer;
- The amount of profit and net income from sale of products - allows to estimate the resource capacity of the enterprise to make the transfer;
- The amount of the finished products and the level of its updating - allows to estimate the internal capabilities of the enterprise for transferring technology.

In order to develop a comprehensive strategy for technological development of enterprises, identify priorities for an enterprise and ways to support innovative development, formulate a comprehensive program of measures to improve its efficiency, it is proposed to distinguish the main components of the technological base of the enterprise. They include:

First, the main production technological processes for creating core products;

Secondly, technological infrastructure (logistical support for the production process, transportation, warehousing, energy supply and control, informatization and automation of administrative jobs of technological departments);

Thirdly, intellectual property objects (licenses, patents, research activities, own innovative, scientific and technical developments);

Fourth, technological culture (qualification of technological personnel, environmental friendliness and sociality of technologies, management system of product quality and competitiveness of the enterprise).

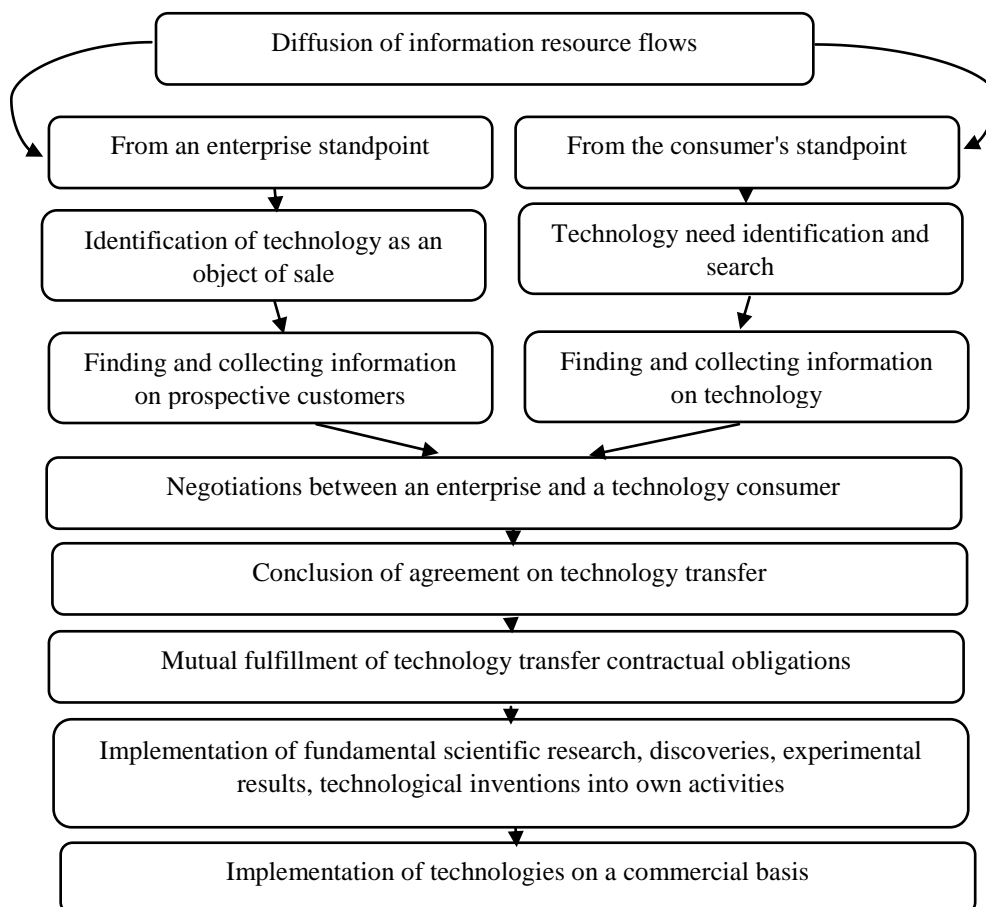
Depending on the level of radicalization of innovative transformations, the following directions of technological base development are possible:

- 1) Alteration the type of workflow technology (production type);

- 2) Introduction of new technologies and technological processes;
- 3) Reengineering of technological processes (restructuring in order to optimize and streamline the production process without significantly changing the production technology itself by rationally placing individual links of the technological process, eliminating their unnecessary components, etc.);
- 4) Replacement of a separate technological process or its elements (the process of improvement of the existing technology);
- 5) Upgrading and redesigning technological equipment (measures to optimize and improve the support of the main technological processes through the use of technological equipment of proper quality in accordance with the design and technological specifications of the product, the type and volume of production).

The necessity to activate innovative processes poses a challenge for enterprises to improve the technology transfer management system, which provides for: 1) determining the need for technological development; 2) technology assessment; 3) technology transfer planning; 4) implementation of technology transfer.

For enterprises, a system of stages is proposed, which would take into account the positions of both the enterprise and the consumer and would perform a kind of diffusion of flows of information resources (Figure 1).



Source: Author's development

FIGURE 1
DIAGRAM OF TECHNOLOGY TRANSFER STAGES IN THE PROCESS OF INNOVATIVE

DEVELOPMENT OF THE ENTERPRISE

The presented diagram, when implemented in practice, will enable the enterprise not only to use certain technological knowledge once, but also to develop internal potential, gradually turning from a passive technology transfer processes participant to an active one. Technological development of enterprises will eventually become the basis for intensifying their participation in international technology transfer, because at this stage, not all enterprises are able to provide effective cooperation with foreign partners.

RECOMMENDATIONS

Many enterprises go round in circles: they produce products they are capable of producing, given the technological level of production. The fact that the products are technologically obsolete does not make it possible to increase profitability of the enterprise, and therefore, to develop investment resources to stimulate innovation activity at a higher technical level.

In such conditions, according to the authors, the stages of implementation of the strategy for activation technological transfer should be as follows: stage 1 should provide for activation of managerial and organizational innovations, which should prepare the enterprise for more active innovative activity and to create effective systems and structures for technology transfer management; stage 2 should involve development and introduction into production new types of products by own efforts of the enterprise, with the purpose to create financial preconditions for technological modernization of the enterprise; stage 3 should provide for technological retrofitting of the enterprise at the expense of its own and attracted investments and active transfer of technologies. Accordingly, the main task that enterprises need to solve is to ensure the fastest possible reorientation of profits to new activities, to technological upgrades.

CONCLUSIONS

Activation of technology transfer processes requires a clear understanding of their essence, advantages, type, which will allow the enterprise to develop technological development strategies on a systematic and integrated basis. That is why the study of the theoretical basis for the development of technology transfer processes can complement existing scientific developments.

Technology transfer is one of the strategic goals of enterprise development and requires a system-based management. Forming mechanisms for providing transfer in practice means not only finding and utilizing technological developments of other enterprises, but also developing the enterprise's ability to independently develop and implement modern technological solutions. Understanding the technology transfer stages discussed in this section will allow implementing the existing business practices and transforming technology into a leading driver of sustainable development.

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