Technology transfer as a factor in improving the competitiveness of industrial enterprises

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Abstract: The publication examines the importance of technology transfer for enhancing the competitiveness of industrial enterprises in Bulgaria. The nature, characteristics and main forms of technology transfer are analyzed. On this basis, summaries of the current state of technological transfer in Bulgarian industrial enterprises are made.

1. Introduction
Increased globalization and integration of the world economy requires the use of new theoretical and practical tools for the economic development of countries. The specific peculiarities of the economic situation are associated with constant changes in the business environment and barriers to the entrepreneurial activity of industrial enterprises. The impact of these negative processes can be reduced by ensuring effective technological modernization through innovation (technology transfer), which will increase the competitiveness of industrial enterprises and ensure their development in the short and long term.

2. Nature and characteristics of technology transfer
Most often, technology transfer is defined as a continuous process of knowledge transfer generated by universities, government agencies, and any institution capable of generating enterprise knowledge. This allows companies to innovate and expand their technological capabilities in order to gain competitive advantage in the market. Technology transfer is generally understood to mean the transfer of scientific and technical information from basic science through applied and development activities in the field of production and consumption. Most important for technological transfer are the processes of transferring systemic knowledge from the field of science to the field of production. These processes are very important because of the differences between the nature of science and production, which creates the need to overcome major obstacles, as well as the high value and the possibility of multivariate transfer associated with the need to optimize choices.

In a narrow, operational sense, technology transfer focuses on vertical transfer processes through which technological design becomes a real production technology. Thus the transfer of technology as content is a mechanism to support the innovation process in each of its major stages.

J. Langrish believes that „Technology Transfer is the use of a technology by a new user / s. This is a process in which technology developed for one purpose finds a new application or a new user. This activity is mainly related to increasing the use of existing scientific / technological basis by applying it
to new fields as an alternative to expanding its application as a result of further research and development”[4,11,12].

Solleiro and Urbano define technology transfer as the transmission of knowledge in a continuous, frequent, and strategic manner, which is applied to research in government technological agencies, laboratories, universities, and any institution capable of generating knowledge as indicated by [16,17].

According to Hamidia, Rast and Chilana, technology transfer entails an agreement and presupposes payment and, therefore, the commercialization of knowledge is inherent in this process [6,15,2].

Omar, Wang, Audretsch, Huuck and Kundu indicate that access to technology, regardless of where it has been developed, has constituted an important instrument in the economic growth of countries and organizations, because it promotes changes in society, creating new needs and satisfiers [14,18,1,8,9].

Authors like Lundvall, Wang, Hall and Diebold show that a country has a competitive advantage that depends on knowledge and technology transfer [10,18,7,3]. Woerter notes that companies get involved in transfer activities in order to update and modify their knowledge base and consequently, improve their competitiveness [19]. Georgieva defines technology transfer as a process in which technologies, knowledge and / or information developed in one organization within one area or for the achievement of one purpose are absorbed and used by another organization, in another area or for the achievement of others goals [5].

Technology transfer or technology transfer is the process of sharing skills, knowledge, technologies, production methods, production patterns and facilities between governments and other institutions to ensure that scientific and technological development is accessible to a wide range of users, who can further develop and exploit the technology in new products, processes, applications, materials or services.

Technology transfer involves the acquisition and acquisition of technology in order to bring innovation and efficiency to gain competitive advantage.

Technology transfers can be made in different ways grouped into so-called commercial and non-commercial transfer (table 1):

| Classification | Type of technology |
|----------------|--------------------|
| 1. Trade Transfer | leasing transfer |
| | licensing |
| | patented invention |
| | know-how agreements |
| | franchising |
| | Joint ventures |
| | involve the company in a subcontracting chain |
| | trade in scientific results |
| 2. Non-commercial transfer | the free dissemination of scientific and technical information through the publication of scientific and educational literature, patent descriptions, technical standards, abstracts, etc. publications of conferences and symposia; |
| | direct exchange of views; |
| | joint basic research and free exchange of results; |
| | secondments of specialists for the exchange of technological and production experience; |
| | Scientific specializations at foreign universities; |
| | doctoral studies at technological universities and centers. |
2.1. *Forms of commercial trade transfer*:

- Sale of rights to a patented invention - the owner of the exclusive rights obtained with a patent for the invention transfers them to another natural or legal person without restrictions on time and other conditions. This transaction is known as "assignment". The new owner is entitled to both manufacture on the basis of the invention (technology) and sell licenses to third parties;

- Licensing - acquisition for a fee of a right to use foreign inventions, trademarks, utility models, industrial designs, processes and technologies for production and other elements of production experience and knowledge, whether secured or unsecured. A major object of licensing is the patented invention. The owner (the licensor) authorizes to carry out in the country and for a limited period of time one or more actions which are within the scope of the exclusive rights obtained by him as a result of the patenting of the invention in the respective country;

- Know-how agreements - know-how means "knowledge and practical experience" of a technical, commercial, managerial, financial or other nature, which are: - practically applicable in production and professional practice - not generally known - absent legal protection;

- Acquisitions and mergers - the acquisition is an expression of the purchase of the whole or part of the company, so that the acquired company is fully absorbed by the acquiring company and ceases to exist as an independent entity in the business. The acquisition may be different depending on the agreement of the two parties, the method of financing, the purpose of the acquisition and other factors. The merger is an expression of the merger of two or more separate companies into a single voluntary entity and generally on an equal footing. In practice, one firm is usually stronger, retains its identity and management style, and absorbs the assets and liabilities of the other firm;

- Franchising - a form of business in which the "franchisor" grants the rights to use its trademark to the production of a product or service of another company called a franchisee against franchise fees and royalties.

- Turnkey project - this form provides for the conclusion of an agreement for the design, construction and assistance in the initial operation of a plant with one or a small number of technology suppliers. The client may also participate in the implementation of the project. The important thing here is that the customer receives technical information about the plant's operation, technical services and assistance, and under certain conditions and rights to the technology. Through this form, innovation is more often diffused;

- Joint ventures. Two or more parties (companies) pool their resources and experience to produce or sell a product or to provide services. Often the motive for setting up a joint venture is to reduce the risk of learning a new technology or product by distributing it to individual participants;

2.2. *Non-commercial forms of technological transfer*

They serve to obtain information and knowledge mainly of a fundamental nature it is possible to transfer applied knowledge, but in scope and nature, they are usually not sufficient to carry out the entire cycle of technological transfer. The main forms are:

- To the free dissemination of scientific and technical information through the publication of scientific and educational literature, patent descriptions, technical standards, abstracts, etc.;

- Publications of conference and symposium materials;

- Direct exchange of views;
− joint basic research and free exchange of results;
− secondments of specialists for exchange of technological and industrial experience scientific specializations in foreign universities;
− doctoral studies at technological universities and centers.

3. Technological transfer in the Bulgarian industrial enterprises

In Bulgaria, just over 91% of business entities meet the definition of micro-enterprises. Another 8.6% are representatives of the SME group. The presence of such a structure of the business organizations in the country, determines the lack of traditions for participation in joint, incl. and innovation. Companies rely mainly on their own limited capabilities to undertake projects to upgrade production processes and product portfolios.

Figure 1. Technology transfer by industry [13].

According to National Statistical Institute (NSI) data for 2019 the highest is the share of technology transfers in the high-tech sectors (Figure 1). Data show that 35% of technology transfers are made in the information technology sector. The pharmaceutical sector is second with 32% and the medical sector with 17%. In industry, the relative share of technology transfer is 5%, well below the EU average of 28%. In research and development, technology transfer is 8%. Sector others accounted for 3% of technology transfer. These include activities such as the production of electronic and optical products, radio and television activities and telecommunications.

Figure 2. Forms of technological transfer in industrial enterprises in Bulgaria [13].
The main forms of technological transfer are commercial and non-commercial. Bulgarian industrial enterprises in the last 2017 to 2019 there have been positive changes in some forms of technology transfer. Industrial enterprises transfer technology mainly in the form of workshops and seminars, trade shows, licensing deals and know-how contracts. Next in the ranking of franchising, foreign direct investment, leasing and research activities (Figure 2).

A study by the European Innovation Center shows that in Fig. 2 forms of technology transfer have been implemented through: technology transfer offices, technology parks and centers, business incubators, spin-offs and start-ups. 53% of industrial enterprises have implemented technology transfers through regional and national business incubators, and 47% as a result of spin-offs. Startups used 44% of technology startups, 37% used technology centers, and 26% used technology transfer offices. Through technology parks, 2% of industrial enterprises have made technology transfers [fig. 3].

Figure 3. Mechanisms for technology transfer [13].

Figure 4. Level of technological transfer from research units to companies [13].
As can be seen from fig. 4, the main barriers to building links between research and production are the lack of interest on the part of enterprises, the lack of qualified staff, inadequate laboratory equipment, the lack of adequate facilities and the presence of institutional problems. The most important factors preventing the creation of links between research and production environments are of a quality character and relate to culture (individual and institutional), and technical barriers (adequate infrastructure and premises) are considered less important.

4. Conclusion
Successful business in an unstable and unpredictable environment requires maintaining intensive interactions with many partners and counterparties. The rapid development of modern technologies and the transformation of formal and informal knowledge into a key factor for competitiveness require new rules of interaction within the innovation and industrial networks - use of the whole variety of channels for exchange of information, speed for decision-making, expansion of contact groups. The efforts of the Bulgarian Government should be directed to:

- Encouragement of inter-company interaction - scientific and technical alliances (sustainable association between companies for joint financing of research and with possible participation of universities and independent laboratories), consortia (voluntary association between independent organizations for the purpose of carrying out a specific project, after which the existence of the consortium is terminated) and the joint ventures;

- Intensification of interaction between university units and business. Due to their functions to carry out basic research and train highly qualified specialists, universities are an extremely important element of innovation systems. Their importance for the effective functioning of the national innovation system is growing under the influence of a number of factors: the pronounced multidisciplinary nature of teaching and research; the fading boundary between purely scientific and purely applied research; growing demands on the quality of the prepared human resource and its ability to absorb new knowledge and adapt to the changing environment;

- Development of intermediary infrastructure. The dynamics of the environment, the accumulation and complexity of technological knowledge stimulate the creation of intermediary organizations with diverse functions and scope of action. The innovation environment is becoming more diverse. The concentration of a specific information, financial and human resource, specialized in the implementation of specific functions within the innovation networks, enables their use at minimal single costs by the organized user (innovative company) or the individual inventor. The achievement of a higher level of internal system specialization is manifested in the improvement of the quality of the final product and higher added value for the system as a whole;

- Maximizing the potential of public-private partnerships. They are implemented with the joint participation of publicly sponsored research sector in the face of state universities and research units on the one hand and private business on the other. The capabilities and quality of infrastructure from public organizations are crucial to the innovative development of businesses when it comes to accessing new technological knowledge, providing financial support, or as a market for new applied developments or non-technological innovation;

- Accelerate the processes of innovation clustering. Despite the efforts of many countries in recent years to build national innovation systems and to implement national strategic and programmatic documents for the development of innovative potential, it is clear that it is at the regional level that the specificities and characteristics of individual territorial communities can be felt, often deviate significantly from the macro level averaged values by key economic
indicators. In this sense, innovation clusters solve several problems: they express the state of the regional economy and the specificity of its innovation potential; allow targeted impact on those factors that are critical to a particular region; help overcome inter-regional disparity in status and dynamics based on unique competitive advantages for each region.

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