APPROACHES TO THE STUDY OF TECHNOLOGICAL COMPETITIVENESS OF THE NATIONAL ECONOMY

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Abstract. The article is devoted to the consideration of theoretical approaches to the study of technological competitiveness of the national economy. The paper analyzes the technological competitiveness of the national economy in terms of: characteristics of actual trade specialization of the economy; the level of innovative potential of the country; national technological capabilities; a comprehensive approach that takes into account a broader range of factors that influence the technological potential of the economy. Outlined approaches provide an understanding of the impact of technological factors on various aspects of the economic development of the country, which create certain conditions and opportunities for the development of national competitive advantages. The author proposes his own approach to the assessment of technological competitiveness of the economy, which is based on the identification of features and tendencies of the process of creation, involvement, dissemination and use of technologies, knowledge, innovations in terms of the integrity and systematic of technological process in the economy. It is based on structural and technological transformations caused by technological upgrading of the production structure and its adaptation to the changing conditions of the local and global environments. Thus this leads to significant shifts in the branch structure of the economy, especially in the direction of increasing the share of innovative industries and high added-value activities.
Keywords: technological competitiveness, innovation, export specialization, technological capabilities, competitive advantages

Introduction

The intensification of international competitive challenges necessitates the search by countries for new advantages that can enhance their competitiveness. The importance of traditional competitive advantages, especially those based on low labor costs, has already diminished considerably. A significant increase in the competitiveness of the national economy in modern conditions is ensured only by participation in technological competition both in the world and in the domestic markets. As K. Holroyd noted, the support for scientific and technological innovations in the 21st century is what access to natural resources and production capacity were in the 19th and 20th centuries [7, p. 34]. In the long run, it is the potential of new technologies that forms the main source of competitive advantages.

Analysis of recent research and publications. In most cases, the manifestations of technological competitiveness of the national economy are described by researchers in the context of the influence of a technological factor on the dynamics of foreign trade, which counteracts the role of factors of exchange rate or cost competitiveness. Sometimes, some components of technological competitiveness are considered – innovative economic competitiveness [16] or innovative provision [18], dimensions and components of technological modernization of industry [17]. At the same time, some researchers gradually find the roots of technological competitiveness in the internal potential of economic development of the country. According to K. Momaya, technological competitiveness is the ability to develop, transmit, master, produce

or commercialize technologies to maintain competitiveness [13]. J. Fagerberg linked it to its innovative potential and ability to mimic the technological achievements of other countries [5]. M. Kassidi, D. O'Brien under the technological competitiveness understand the innovative and adaptive potential of the economy [3, p. 17]. D. Chervanyov and O. Zhilinskaya define the scientific and technical competitiveness of a country, which they consider as a country's ability to generate and maintain competitive advantages in the field of generation, dissemination and application of new knowledge through the effective use, enhancement and modernization of its scientific and technological potential in the context of globalization [4, p. 21].

Statement of purpose of the article. The purpose of the article is to identify the main approaches to the study of technological competitiveness of the economy. Achieving this goal requires several tasks: to distinguish approaches to the study of technological competitiveness of the economy; determine their meaningful features.

Research results. In many studies on the issues of competitiveness of the national economy, the technological factor is taken into account in the way of using individual indicators that influence changes in the characteristics of its innovation or technological development determine the position of the country in the world market of goods and services.

Given the traditional analysis of the competitiveness of the economy in terms of the dynamics of its foreign trade indicators, many researchers have argued that technology plays an important role in shaping the trade pattern of countries, and therefore the technological characteristics of foreign trade specialization of the country reflect the level of economic competitiveness [8]. One of the first approaches used by researchers to determine the technological competitiveness of the economy were to analyze the characteristics of the actual trade specialization of country – in terms of exports to international markets of goods of different technological complexity. For these purposes, various classifications of goods exported by countries are used to distinguish between high- and low-tech branches of industry or groups of goods to assess the level of technological complexity of goods according to the main factors of production used (human capital, physical capital, labor and other resources). This approach considers that if a country competes successfully in high-tech industries and its companies are present in markets where quality and know-how are more important factors of competition than the use of low prices, this is evidence of its technological competitiveness [19].

Thus, comparing the dynamics and scale of trade in high-tech goods and services, we can conclude that countries have a relative ability to enhance their competitive advantages by increasing output in industries characterized by high levels of use of knowledge and skilled labor. Thus, a number of theoretical models suggest that countries that specialize in technologically progressive ("high-tech") activities will achieve high rates of productivity growth than other countries. Countries that specialize in "low-tech" activity, on the other hand, will have relatively slow productivity growth [6, p. 394]. A country's ability to succeed in high-tech or technology-intensive industries can be seen as an indicator of its competitiveness in high-growth industries. At the same time, export opportunities for high-tech products were evaluated on the basis of factors that lead to adaptation and technology creation. Separate studies have determined the dependence of export performance on a broader range of factors, including the spread of technological innovation in different sectors, the type of technological specialization (reflected by indicators of the technological structure of patenting, production with high or low technological capabilities), and the ability to adapt to improve technologies and create innovative sectors of the economy [14, p. 532].

A number of authors link the technological competitiveness of the national economy to the level of innovative potential of the country. In practice, various indirect indicators are usually used to determine the costs or results of an innovation process. The most common cost indicators relate to R&D resources, such as R&D expenditures or human capital intensity (R&D staff). They reflect the factor component of technological competitiveness. At the same time, indicators of patent applications or the number of patents received, the technological intensity of an industry or economy in many empirical studies are used as indirect indicators of technological development or industrial

innovation performance, a criterion for the country's innovation potential.

The analysis of the technological competitiveness of the national economy "in terms of technological capabilities" [10] shows that competitive differences between countries arise from divergences in their technological capabilities, that is, abilities to master, adapt, effectively use and create technologies for efficiency and productivity enhancement. At the same time, the owning of advanced technologies does not guarantee the competitiveness of the economy. Access to cutting-edge technologies is a prerequisite, but the upgrading of technological equipment must be accompanied by the development of knowledge and skills that will facilitate the effective development of technologies, their adaptation, improvement and ultimately the creation of new technologies in the country.

There are differences in how researchers define the notion of technological capabilities. M. Caniels and H. Romine view them as "skills, knowledge and organisation needed to absorb, reproduce, adapt and improve new technologies" [2, p. 130]. K. Petrobelli defined them as "the complex set of human skills and organizational structures required to utilise a given technology efficiently and improve it over time" [15, p. 121]. At the same time, the researcher argued that the technological capabilities of the economy imply not only the achievement of production efficiency, but also the ability to adapt to the technological process, changing conditions in the markets of goods and factors of production. M. Bell and K. Pevitt expanded the notion of technological capabilities to include the resources they need to manage the process of creating technical change, noting that such resources are accumulated and embodied in the qualifications, knowledge and experience of people and organizational systems [1]. That is, the concept of "technological capabilities of the economy" encompasses factors related to knowledge and skills, organizational structures and external relationships necessary to obtain, use, adapt and create technologies.

S. Lall stressed that the process of using new technologies is not automatic or straightforward. Technology transfer cannot lead to effective activity unless the necessary experience, skills and technical and managerial know-how are created [11, p. 170]. If investment is not accompanied by skills development or the development of technologies necessary for their effective use, national technological capabilities will not be developed properly. This is because technology has a significant implicit component, that is, contains knowledge that is not fully or partially formalized, and therefore less mobile and more difficult to transmit and reproduce in other places than embodied, codified and formal technical components. Mastering such an implicit component of technology requires a long period of learning by the recipient. This learning may be partly an automatic result of production experience, but in most activities it also requires targeted investments by companies in new skills, procedures, technical and organizational information, as well as the development of organizational capacity to create, transfer and disseminate knowledge. S. Lall noted that the impact of technological opportunities on the national economy competitiveness depends on the incentives provided to economic agents or is a result of the state policy implemented or incentives that are formed by the institutional characteristics of the economic system. The key in this model is the concept of "externalities", which defines the possibility of spreading new knowledge in other activities [12, p. 340].

S. Lall explained the significant differences between countries in technology efficiency and competitive advantages, respectively, with differences in "national learning systems" (scilicet systems of measures and incentives that determine the ability of national companies to deepen knowledge, accumulate technological experience and learn technology) and indicators of attraction of technologies to the economy [10, p. 7]. According to S. Lall, government learning policy is becoming the main determinant of the country's competitive advantages. Overcoming the lagging behind in the level of competitiveness of the economy implies the ability of the country to create conditions for ensuring the process of economic growth on the basis of a continuous process of "learning", which in turn is supported, on the one hand, by stable investment in human capital, and on the other - by actively directing efforts towards technology development and innovation. At the same time, in addition to ensuring the efficient use of technology, it is important to build the capacity to create new technological solutions.

The high-tech competitiveness indicators were developed by researchers at the Georgia Institute of Technology's Technology Policy and Assessment Center. They identified four

groups of high-tech competitiveness indicators [9]: 1) the national orientation – reflects a country's commitment to technology-based development and the introduction of technological competitiveness measures; the assessment is carried out in the following areas: the presence of a favorable state policy for the development of high technologies, social factors that contribute to technological change, the acceptance of the idea that development should be based on technology, the presence of entrepreneurial spirit; 2) socio-economic infrastructure – assesses the basic material, financial, organizational and human resources needed to support the technology-based development of modern economies; takes into account the effectiveness of the country's education system (proportion of the population receiving secondary and tertiary education), estimates of capital mobility and stimulation of foreign investment; 3) technological infrastructure – evaluates the social and economic institutions and resources that contribute to a country's ability to develop, produce and market new technologies; it is evaluated on the number of scientists involved in R&D, the cost of acquiring electronic data processing equipment, survey data on the country's contribution to the international fund of scientific and technical knowledge, its ability to train qualified scientific and engineering personnel, to effectively use technical knowledge and implement R&D output in manufacturing; 4) production potential – defines the material and human resources aimed at the production of products and the efficiency with which these resources are used; it combines an indicator of electronics production volumes and survey results on the quantity and quality of workforce in industry, availability of local component suppliers for high-tech products, manufacturing and management capabilities to develop, produce and sell high-tech products. In this model, the technological situation is the output indicator that reflects the country's overall achievements in the export of high-tech products and is calculated on the basis of export volumes of high-tech goods and electronics and an assessment of the country's ability to produce high-tech products.

The advantage of this approach is to consider a much wider range of factors that influence the formation of the technological potential of the economy. At the same time, it allows us to draw some conclusions about the technological capabilities of countries for the production and export of high-tech products scilicet it takes into account only a separate component of the technological competitiveness of the economy associated with the positioning of the country in certain segments of the global market for complex technological products.

Outlined approaches provide an understanding of the impact of technological factors on various aspects of the economic development of the country, which create certain conditions and opportunities for the development of national competitive advantages. At the same time, in our opinion, the study of technological competitiveness should be based on the identification of features and tendencies of the process of creation, attraction, dissemination and use of technologies, knowledge, innovations, in terms of the integrity and systematic process of the technological process in the economy. Thus, the technological competitiveness of an economy can be defined as the set of conditions, factors and opportunities inherent in a national economy that determine its ability to generate the potential of dynamic and continuous restructuring through the creation, development, implementation and diffusion of innovations, new knowledge and technologies. This implies understanding: first, the sources and conditions of the formation of the internal potential of the economic system to create technologies and stimulate innovation; secondly, the mechanisms of interaction of the national economy with the global environment in order to attract the necessary technological developments and new knowledge necessary for competitive development; third, systems of factors and conditions that contribute to the diffusion of technologies and innovations in various industries and sectors of the economy in order to ensure their technological modernization and improvement of production processes; fourth, the factors that determine the ability to effectively learn and use technology and apply innovative developments in the economic activity of companies; fifthly, the conditions of formation and change of demand of different sectors of economy for new technologies and innovations.

Conclusions

Differences in competitiveness between countries result from their ability to create, master, adapt and effectively use technology. The ability to enhance the technological competitiveness of the national economy is ensured by the depth of structural and technological transformations caused by technological upgrading of the production structure and its adaptation to the changing conditions of the internal and global environment. This leads to shifts in the structure of the economy, above all – in the direction of increasing the share of innovative industries and high value-added economic activities. Technological and innovative factors make it possible to lay the foundations for enhancing the long-term competitiveness of the economy based on the creation of technological competitive advantages, conditions for the formation, accumulation and efficient use of knowledge, technological, investment resources and more. In such circumstances, an economy that is capable of not only succeeding in the world market but also adapting the internal parameters of economic development is competitive.

The scientific novelty of the research results is the systematization of approaches to the study of technological competitiveness of the economy and determination of their substantive features. It will allow us to elaborate theoretical bases for definition of the holistic and systematic concept of technological competitiveness of economy. Further studies of the technological competitiveness of the economy should be aimed at determining the content of mechanisms for providing its individual constituent elements and determining the indicators for its evaluation.

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