

Business Environment Institutions as a Catalyst for Knowledge and Technology Transfer

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Abstract: Knowledge and innovation are key resources of the modern economy. Innovation, transfer, and use of knowledge determine the pace and level of economic development. The ability to transform knowledge into new technologies, products, services, marketing methods, and organizational solutions is both the basis of entrepreneurship and building a competitive advantage that increases the enterprise's chances of maintaining its market position. However, the market commercialization of new knowledge in the form of cutting-edge technological solutions or new products is a complex process with a high risk of failure, thus requiring appropriate and different competencies. Moreover, there are numerous barriers at the point of contact between the worlds of science and business that significantly impede joint work on innovative projects. Therefore, specialized entities have emerged to transfer knowledge and technology from science to the economy. These entities organize the knowledge flow from entities that have to those that seek knowledge. A professional institutional base in this regard is developed by innovation and entrepreneurship centers that partner with both private and public sectors. These centers act as a catalyst for the flow of knowledge and are responsible for building a platform for dialogue and cooperation between science and business, thereby providing conditions for improving the efficiency of knowledge and technology transfer. Their activities are aimed at meeting the needs of entrepreneurs primarily related to the development of innovation, promotion of experimental activities, technology transfer and commercialization of knowledge, and improvement of competitiveness based on new technological solutions. The aim of the present paper is to indicate the importance of business environment institutions to the transfer of knowledge and technology between science and business.

Keywords: Business environment institutions, Knowledge and technology transfer, Commercialization of knowledge

1. Introduction

One of the elements that shape the activity of entrepreneurs is the institutions that support their activities to reduce uncertainty. Over the past few years, there have been efforts in Poland to create a stable infrastructure to provide long-term support for innovation, with its foundation being knowledge. It is difficult to plan and implement any changes without adequate knowledge potential while innovations create the demand for new areas of knowledge, which are constantly developed. Being aware of these conditions, the governments of developed countries pursue a policy of supporting the transfer of knowledge and technology, using a whole range of means for this purpose.

The basis of contemporary entrepreneurship has become the acquisition of new technologies and knowledge necessary to run a modern business. Knowledge and the ability to transform it into innovations significantly affect the competitive position of the company. Unfortunately, the technology and knowledge transfer at the interface between science and the economy is a complex and multifaceted process accompanied by a high risk of failure. Its implementation requires well-defined and different competencies, which both environments sometimes lack. Specialized institutions have been created to reduce potential risks and overcome any barriers that hinder cooperation between people of science and business. They are an important element in the process of increasing the innovativeness of the Polish economy. Business environment institutions, in particular innovation centres, act as a catalyst for knowledge flow by facilitating the implementation of new solutions into business practice.

In the era of rapid technological change and dynamic expansion of innovation into the areas of services, organization, marketing, and social issues, enterprises are looking for new solutions in which the activities of innovation and entrepreneurship centers, which are a professional institutional base for knowledge exchange and its commercialization, prove helpful. The activity of business environment institutions consists primarily in supporting activities for innovation and development of enterprises in the SME sector. The paper presents the essence of the functioning of support institutions and indicates their importance in the process of technology transfer and commercialization of knowledge.

2. The Essence of Knowledge and Technology Transfer

Nowadays, the innovative development of enterprises is attributed to knowledge, which, in the era of constant competition in the market and dynamic globalization, is considered a unique resource (Wolski, 2018; Rychta, 2022). Unlike other goods, knowledge, which is a mixture of experience, values, the information set in a specific context, and expert insight that provides a framework for the evaluation and gaining new experiences and information, does not wear out (Wiśniewska and Głodek, 2015). Its resources during use do not decrease but increase due to improving skills and generating new ideas (Michalak and Zagórowski, 2017). Knowledge resources are natural assets of research centers, universities, and large corporations, but they also exist among customers and other actors in the economy (Łobejko and Sosnowska, 2013). However, knowledge should not be limited to individual entities but flow to other areas of the economy. Therefore, its dissemination is essential.

The process of knowledge transfer from an entity with knowledge (the technology donor) to an entity that needs it and is willing to apply it to its business activities (the technology buyer) is knowledge and technology transfer (Radło *et al.*, 2020; Reit, 2022; Marszałek, 2022). It is composed of two components of transmission involving collecting knowledge and technology and then sending them to a potential recipient, and absorption, that is, the adoption and acceptance of knowledge and technology (Wiatrak, 2018; Stelmaszczyk and Jarubas, 2019). Knowledge transfer requires the need to understand the essence of scientific discoveries, to see the potential possibility of their commercialization and market usefulness, and to know the regulations governing their acquisition, management, and legal actions (Szewc, 2014).

Providing the knowledge and information necessary for one entity to be able to replicate the work of another is part of the commercialization process, which means all the activities related to the transfer of specific technical or organizational knowledge and related know-how to business practice. Commercialization is the process of creating value from knowledge, adapting or making it available for economic and social purposes, and transforming knowledge into competitive products, services, processes, new technologies, and organizational solutions. Commercialization is a specific case of communication and involves a whole set of events aimed at the successful marketization of knowledge, and thus the placement of products using a given technology on the market for the purpose of achieving economic benefits and building the added value of the technology (Bartoszewicz *et al.*, 2019; Łobejko and Sosnowska, 2013; Wiśniewska and Głodek, 2015; Trzmielak and Grzegorzczak 2014; Konopka-Cypiał, 2020; Szewczuk-Stępień, 2016; Radło *et al.*, 2020; Jurewicz, 2021). Commercialization is also an essential mechanism for generating innovation because of the strategic importance that innovation has for increasing economic efficiency and competitiveness.

The transfer of knowledge and technology should allow the participants in the process to achieve mutual benefits, which may be commercial (economic benefits) or social (depending on their application, these may include technological, environmental or health benefits). Knowledge and technology transfer strengthens recipients' potential and skills, as well as the conversion of research results to their own needs. At the same time, by selling knowledge and technology, the entities raise funds for the development of research and its subsequent transfer. The prerequisite for receiving each type of benefit is the interest of the recipient, supplier, and intermediary institutions in the transfer and their cooperation in the process of acquisition and application of new solutions. It is important that the knowledge received can be used by the recipient and matched to their capabilities under existing conditions. Therefore, you should prepare for the transfer, taking into account its individual phases (Trzmielak and Grzegorzczak, 2014; Wiatrak, 2018; Radło *et al.*, 2020). When preparing knowledge and technology for transfer, it is necessary to determine not only the type, scope, or time of delivery but also to indicate the conditions for their use in practice. Delivery can be combined with consulting and training offered by the business environment institutions to facilitate their implementation and application.

3. Specifics of Functioning and Classification of Business Environment Institutions

Business environment institutions (BEIs) are an institutional form of support for innovative entrepreneurship and technology and knowledge transfer. They are elements of innovation potential seen as a set of characteristics of a given territorial system that foster innovative activity undertaken by business entities operating in that system. Enterprises' innovativeness can be attributed to both their organizational capabilities and their connections with other actors in the environment, while communication, cooperation and coordination are prerequisites for the creation and transfer of knowledge and technology (Golejewska, 2017).

Business environment institutions are nonprofit entities or those that use the profit to reinvest in business support activities or cooperation between the sectors of science and business. These institutions have the necessary material and technical base, appropriate human resources and competencies to provide services to the SME sector (Mażewska, Bąkowski and Rudawska, 2021; Kuchciński, 2021). Their functioning is reduced to the following aspects (Mażewska, Bąkowski and Rudawska, 2021):

- they are service-oriented entities linking businesses with entities in the sector of science, which is at least to some extent publicly funded,
- they are entities that do not operate for profit (non-for-profit) or allocate the profit obtained for statutory purposes, i.e. supporting entrepreneurship and innovation of their beneficiaries,
- they have an adequate base of both tangible (real estate and movable property) and intangible resources (knowledge and qualifications) and adequate personnel to provide services,
- their goal is to support micro, small and medium-sized enterprises at every stage of their development.

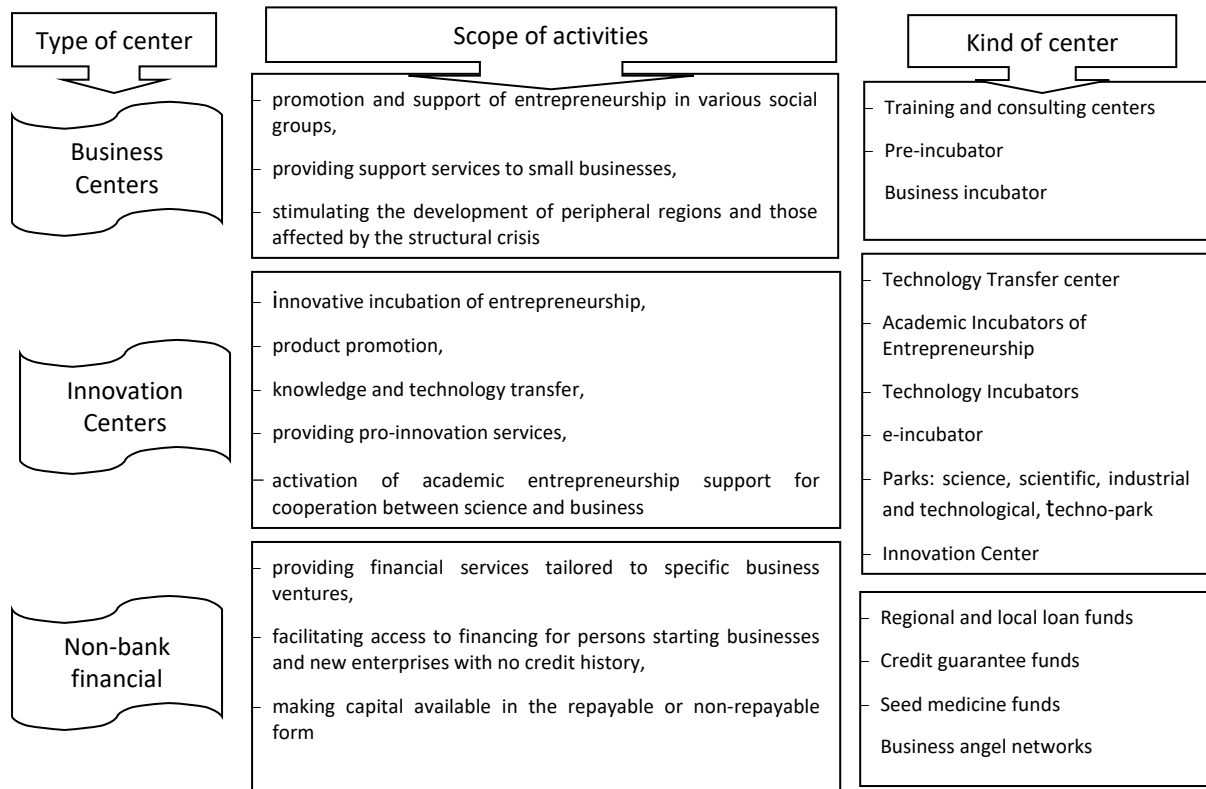
Support institutions act as specific partners of the public and private sectors, initiating a new quality of thinking and management of economic and social development. With the non-commercial and statutory orientation of business environment institutions to support the development of entrepreneurship and innovation, they provide services and create a specific network-based institutional infrastructure that allows entrepreneurs to implement their strategies and dynamize development processes. Their peculiarities and the social background of their creation make them an important element in bridging the gap between market mechanisms and public administration actions (Gródek-Szostak *et al.*, 2020; Mażewska, 2015; Babuchowska *et al.*, 2015; Trzmielak, 2013).

The BEIs designed to support the development of enterprises in the SME sector by providing the right infrastructure to support entrepreneurship and the transfer of knowledge and technology, thereby creating and implementing innovative ventures, are innovation and entrepreneurship centers. Regardless of the organizational and legal forms of these entities, their activities are focused on (Matusiak, Mażewska and Banisch 2011; Glabiszewski, Grego-Planer and Liczmańska-Kopcewicz, 2018; Rudawska, 2020; Gródek-Szostak *et al.*, 2020):

- transfer of knowledge and technology from scientific institutions to businesses,
- creating a system of linking enterprises with scientific units and administration,
- development of flexible manufacturing systems at the interface between science and the economy,
- spreading knowledge and skills through consulting and training,
- motivation and preparation for self-employment and comprehensive advisory, technical and housing assistance supporting the start of innovative business activity,
- financial and organizational support for innovative ventures,
- creating clusters of enterprises and animating innovative environment by combining business services and various forms of technological assistance in a specific, developed area.

The activities of innovation and entrepreneurship centers consist in supporting enterprises or potential entrepreneurs in three major areas. The first area relates to financial support, the second is the provision of material (space, access to devices) or formal (legal personality) conditions for starting and running a business, and the third includes all kinds of soft services (providing information, consulting, training, support for technology transfer, etc.). Within the third area, one can distinguish a group of services that are particularly interesting from the point of view of innovation, which are referred to as bridging services, while the units providing them are termed bridging organizations. The focus of their activity is on the organization of knowledge flow from entities with knowledge to entities that seek knowledge. Such activities are referred to broadly as knowledge transfer or narrowly as technology transfer, or most generally the transfer of technological knowledge between organizations (Płoszaj 2012; Lisowska, 2016).

The product offered by the business environment institutions is specific and its special character results from, on the one hand, the needs of the units served – in most cases enterprises, and, on the other, is conditioned by the character of the institution itself. Due to the specificity and scope of activities as well as the target group of recipients, support centers can be divided into three basic groups, presented in Figure 1.



Source: Own elaboration based on (Mażewska 2015; Nowak, 2016; Lisowska, 2016; Rudawska, 2020; Mażewska, Bąkowski and Rudawska, 2021).

Figure 1: Classification and Scope of Activities of Entrepreneurship and Innovation Centers

There is no one-size-fits-all organizational or functional model for supporting institutions. They function in various organizational and legal forms, from associations or foundations to limited liability companies. profit oriented. The activities of each institution depend on: resources, adopted mission, efficiency and substantive preparation of employees, their ability to raise external funds for their statutory activities, and their reception by the local community. The effects of their activities often cannot be quantified. The simplest form is training and consulting centers, which focus only on information, advisory and training activities, while the most comprehensive support is offered by technology parks (Nowak, 2011; Wiśniewska, 2011; Matusiak, 2011).

Business environment institutions are very important part of the knowledge transfer and commercialisation. They are responsible for collecting information about scientific discoveries, evaluation of commercialisation potential of those discoveries and supporting scientists in creation and development of their entrepreneurial ventures based on knowledge they are willing to commercialise (Łobacz, 2018).

4. The Importance of Business Environment Institutions in the Knowledge and Technology Transfer Process

Cooperation between the scientific community and business is usually difficult to organize. On the one hand, scientific entities see opportunities in developing cooperation with businesses to a relatively small extent. On the other hand, there is also an apparently low willingness of enterprises (mainly SMEs) to cooperate with other partners, whereas universities and the sector of R&D as a whole are seen as difficult and demanding partners. Furthermore, operating under constant time pressure and focused on the competition in the market, entrepreneurs usually strive to achieve an economic surplus with as little expenditure as possible, somehow forgetting that knowledge and the ability to transform it into innovations allow for achieving a competitive advantage (Łobacz and Niedzielski, 2015; Dominik, 2013). The differences that exist in the approach to the tasks and the nature of work lead to a specific 'communication gap' between science and business, which is being filled by business environment institutions aimed at building the broadest possible relationship between the two worlds, the development of modern technologies and the search for ways to effectively transfer knowledge from science to industry.

The technology transfer and commercialization of knowledge are facilitated by innovation systems that offer a specific type of cooperation between various types of entities and institutions operating in the region, whose main objective is to develop innovative entrepreneurship. In this area, there are mainly activities leading to the transformation of knowledge into new products, services, organizational and marketing solutions, technologies and instruments to support the commercialization phase of an innovative idea. The most important actor in the knowledge transfer and commercialization of knowledge process is the entrepreneur-innovator, who decides to use innovation as a way to improve the competitiveness of the enterprise on the market and takes the risk of introducing it. However, enterprises have different innovative capacity, i.e. access to internal and external sources of applied knowledge, conditioned by their resources and organizational capabilities, largely human potential. In the case of small and medium-sized entities, due to their limited human, technical and financial resources as well as low quality of management, a significant gap is apparent between the innovative capacity and the enterprises' modernization and development intentions, hence the importance of transferring foreign solutions, i.e. providing the necessary information so that a given entity can duplicate the work of another (Robertson *et al.*, 2012; Łącka, 2011; Stawasz 2012; Łobejko and Sosnowska, 2013; Trzmielak, 2013). Furthermore, the tasks involved in commercialization are often too complicated for the direct participants in the technology and knowledge transfer, so the efficiency of these processes depends on the operation of professional innovation and entrepreneurship centers in the region. To accelerate the implementation of new knowledge and technology and effectively follow all phases of the innovation process, entrepreneurs, especially from the SME sector, use the innovative services of support institutions, especially innovation centers, whose primary task is to bring representatives of the scientific community closer to entrepreneurs, which is expected to improve the conditions for innovative entrepreneurship of both partners and contribute to the transfer of knowledge and technology from science and research to the economy, and then their commercialization. Thus, the cooperation of key partners and functional links of technology transfer and knowledge commercialization processes is centered around these entities (Matusiak and Guliński, 2010; Łącka, 2011).

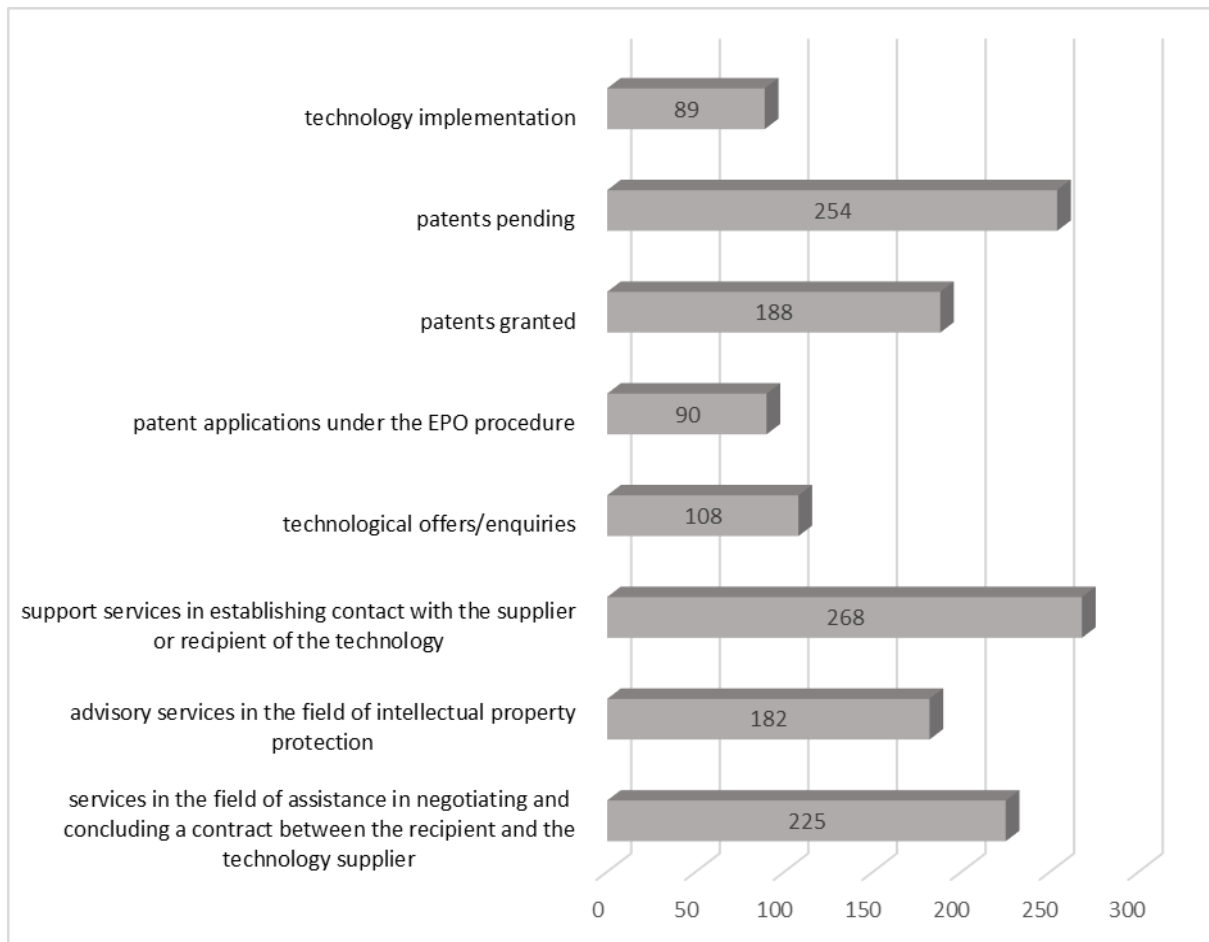
Technology transfer, as an interactive process with the interaction between suppliers and recipients, is a special type of communication process that involves various forms of absorption of innovation and technical knowledge. Designed to intensify these processes, the group of innovation support infrastructure entities is aimed at stimulating research and development activities and implementation of their results through knowledge and technology transfer from the world of science to business and activities focused on the activation of the creative potential of internal resources of enterprises (Szopik-Decpczyńska and Decpczyński, 2013; Dzikowski, 2015). However, effective support for innovative entrepreneurship, technology transfer, and knowledge commercialization must be integrated and comprehensive. All support for innovative ventures is aimed, on the one hand, at stimulating the creation of new technological entities and helping SMEs in their pursuit of technological restructuring. On the other hand, it stimulates research and activates mechanisms for transferring its results to the economy (Matusiak and Guliński, 2010).

Business environment institutions act as an intermediary between the providers such as suppliers of technology and knowledge, and the recipients, who seek them, acting as a catalyst for knowledge and technology transfer. Therefore, during this process, support institutions interact with both the supply and demand sides. In relations with the supply side, they are looking for opportunities to apply the knowledge provided by the institutions of the sector of science and enterprises of knowledge that (at least partially) can be put into practice. Furthermore, in contacts with the demand side, they seek the knowledge that enterprises need to strengthen their market position achieve a competitive advantage based on, among other things, more efficient production technologies or new products. It is worth emphasizing, however, that the effective operation of support organizations should not focus on efforts to control the entire knowledge flow but on the effective linking of producers and consumers of knowledge, who can continue to cooperate without the need for intermediaries or through direct contacts transfer knowledge to other actors (Płoszaj, 2012).

The demand for services of access to new knowledge and specialized advisory and training services in the field of innovation varies significantly depending on the innovativeness of enterprises. Furthermore, limited resources and low levels of management, especially in smaller business entities, and their low propensity and limited ability to assimilate acquired knowledge, are barriers to the use of consulting services. It is therefore important to differentiate the services offered by business environment institutions to different groups of enterprises. This is aimed to support the internal innovative capacity of SMEs, especially the ability to absorb foreign solutions, facilitate access to capital for innovative projects, the effectiveness of knowledge and technology transfer, and strengthen the system of innovative business institutions. Business environment

institutions mediate in contacts between SMEs and the environment and mainly support entities with a small scale of operation, younger and with insufficient knowledge of either foreign sources of innovation or services for innovation. They act as a catalyst for knowledge flow, facilitating the implementation of new solutions into business practice (Stawasz, 2012).

Most innovation centers work on the principle of providing support and advice in the area of commercialization, helping their clients in determining the right commercialization path, searching for partners for implementation, preparing market and patent analyzes necessary to plan technology transfer activities. The result of this work is the implemented new technology or transferred intellectual property. Operation effectiveness of these centers in 2021 is presented in a Chart (Figure 2).



Source: Own elaboration based on (Mażewska, Bąkowski and Rudawska, 2021).

Figure 2: The Activity of Centers Providing Knowledge Commercialization and Technology Transfer Services

However, the decreasing number of the centers themselves is worrying. In 2021, there were 280 entities carrying out the tasks of non-commercial business environment institutions and it was 3 times less than in 2012, when their number was the largest (Mażewska, Bąkowski and Rudawska, 2021). This situation results from the exhaustion of the operating formula of these entities, the change in the business model and numerous structural, systemic, awareness-cultural and competence barriers that hinder or even block the cooperation of scientific institutions with entrepreneurs (Szewczuk-Stępień, 2016; Golejewska, 2017; Kocowska-Siekierka, 2022). An important problem is also the underfunding of the science sector in Poland, low awareness and knowledge about the mechanisms of technology transfer and the principles of intellectual property protection among the teaching staff and the low "absorbency" of Polish enterprises (especially small and medium-sized enterprises) for innovative products, which is caused primarily by the lack of sufficient financial resources. In addition, the offer of business environment institutions operating on the Polish market is quite poor, and the effectiveness of their work is still low. Not without significance is also the high turnover of employees and their poor professional preparation or the lack of specialists as well as the lack of stable sources of financing (Różański and Voytovych, 2019; Gajewski et al., 2019).

5. Conclusions

Access to knowledge and other intellectual resources, especially their absorption, is becoming a key factor in the innovation of enterprises, especially those smaller. The dynamic progress of knowledge and technology as well as growing competition force even the smallest companies to introduce innovations, which have become a necessity and a necessary condition for survival on the market. Small innovative enterprises are usually unable to transform their ideas and concepts into products and services on the market. They cannot create an interdisciplinary research base. To survive, they need to cooperate with others and function in an environment where they can use the knowledge of other entities (Matusiak and Guliński, 2010).

Increasingly, the market success of not only individual enterprise, but also entire economies is determined by the ability to transform knowledge into new products, services, technologies, marketing techniques and organizational solutions. In addition to the entities of business and science, business environment institutions that create a system for supporting, shaping, and promoting innovation and entrepreneurial attitudes and supporting enterprises in knowledge and technology transfer perform a special role. They build partnerships in innovation and establish cooperation between the entities that offer knowledge and those who seek it to create the most favorable conditions for the growth of business innovation (Łobejko and Sosnowska, 2013). A professional institutional base, consisting of various centers of innovation and entrepreneurship, offers a platform linking science and the economy, with its role being to facilitate communication between these environments and provide support by improving the flow of knowledge and technology.

Business environment institutions support the activities of enterprises, affect the absorption of knowledge and innovation, favor the decision-making of location and condition the process of joint learning, thus increasing the competitiveness and innovation of the economy (Lisowska and Grabowski, 2021). However, their number is constantly decreasing, and their share in increasing innovation in Poland is insufficient. This is due to numerous barriers at the interface between science and economy, which hinder the implementation of joint work on the commercialization of knowledge. The process of creating knowledge resources and transforming them into innovations is determined by the ability of multiple actors to work together. Unfortunately, the activities of BEIs are not always professional enough and sometimes deviate from global standards. Therefore, it is important to continuously increase the potential and competencies of such entities, because only well-prepared and qualified personnel and a non-standard institutional base can effectively support innovative entrepreneurship and affect the efficiency of technology and knowledge transfer. It should also be emphasized that like other products, knowledge requires the formation of demand in the environment of its recipients, promotion, and the readiness of the scientific community to identify the demand of the market of recipients, and therefore to analyze the needs of enterprises in terms of knowledge and innovation and invest their time and resources to attract the recipient of this specific product.

The paper does not exhaust the research problem, it is only a contribution to further research on this complex process, which is the transfer of knowledge and technology in the enterprise.

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