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## **The Role of the Białystok Science and Technology Park in Implementing the Smart City Concept**

### **Introduction**

The cooperation between science, business and public authorities is restricted by various legal and spatial conditions. It is additionally hindered by barriers and tensions caused by the lack of common trust, resulting from the belief that the goals of particular spheres can be achieved at the expense of others (Truskolaski 2013). Further restrictions include: too little funds allocated by public authorities for the development of science as well as for own research in the industry. This kind of activity in Poland is still perceived as being highly risky (Nowak 2011). This state can be altered by establishing hybrid institutions, appointed by e.g. public institutions, that concentrate the representatives of science and business and aim at commercial utilization of their experience and knowledge. One of this kind of institutions is the Białystok Science and Technology Park.

The key problem that has been addressed in this article is the insufficient level of cooperation between the three spheres: science, business and public authorities, and the environment represented by society. Hence the superior goals, including socio-economic development, are burdened with an increased risk of failure. The functioning of institutions enabling the integration of particular spheres based on mutual benefits turns out to be a support for the implementation of the superior goal.

The aim of the article is the analysis of influence of Białystok Science and Technology Park on the city. The article presents the process of establishing a hybrid institution in the local environment that will combine scientific and

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business potential. The scope of its activity was described and the impact on the closer (local) and further (regional) surroundings was determined. The article begins with a theoretical overview of issues related to Triple Helix as well as its hitherto implementation in the region. Next, the process of investment implementation is described referring to the objectives to be achieved in the environment. Finally, the first effects of Park's functioning and its impact on the parallel implementation of the smart city concept were presented.

The cooperation (its scope, character, force) between the entities of the three spheres as well as the surrounding environment is evaluated. The direction and size of changes depend on various factors. Finally, the following things are expected: the diffusion of knowledge and the increase in innovation leading to the accelerated development of a particular city/region. The element that unites the particular spheres on the territory of Białystok, which provides the conditions enhancing the creation of innovation, is the Białystok Science and Technology Park. This institution can be considered as one of the first elements on the way to implementing the smart city concept in this territorial self-government unit.

The assumptions of the Triple Helix model constitute the reference points during the analysis of innovation systems based on knowledge. The model refers to various connections and mutual relations in the process of creation and capitalization of knowledge between the three main spheres: science, business and public authorities. They decide on the efficiency of cooperation and the speed of social and economic development.

During the analysis, it was shown that the Białystok Science and Technology Park (BSTP), within its current activity, integrates the representatives of science and business around common problems and expectations as well as supports the creation of knowledge and exchange of experience. Moreover, it is a place where creative solutions are presented, which support the development of the smart city concept. Białystok has the chance to join the so-called smart cities, if the BSTP existing in the city still generates new, innovative undertakings by making use of social expectations with the cooperation of science and business.

The BSTP creates conditions for quality improvement and increase in relations intensity between science, business and public authorities. It results in enhancing the knowledge potential. The Białystok Science and Technology Park is the first step on the way to implementing the smart city concept due to the entities it accommodates. These are, among others, the enterprises from the IT and ICT industry, which directly influence the creation of a smart city.

The creation of the BSTP in Białystok was another step towards the liquidation of the development gap between the Podlaskie Voivodeship and other regions of Poland. The formation of this space has accelerated the processes of information exchange and diffusion of innovation in the Podlasie Region, including Białystok. Based on the data of the City Hall in Białystok and the Central Statistical Office, the generally available classification of economic activity and the industry innovation ranking, the impact of developing the model on the region's innovation level has been presented.

At the beginning of this discussion, attention should be focused on the history and development of the Triple Helix concept and its influence on shaping the policy heading towards the creation of smart cities. The 21<sup>st</sup> century provides many challenges resulting, among others, from digitalization of almost all human activities. Effective utilization of technical advancements can enhance the cooperation between the three sectors with the benefit for the environment and citizens functioning in it.

## **1. Introduction to the Triple Helix concept**

The Triple Helix model, in its base form, is the system of connections between the representatives of the three functional areas, operating on a particular geographical territory, between which there is a transfer of knowledge. To the spheres operating in a particular environment we include enterprises (and broadly speaking: business), the world of science (including universities and R&D institutions) as well as authorities represented by institutions and public units elected in free, democratic elections at the different levels of governance.

The Triple Helix model is a relatively new concept - created at the end of the twentieth century. Its assumptions are derived from i.a. J.A. Schumpeter (Schumpeter 1960). It is the so-called Schumpeter's triade that should be seen as the beginning of the Triple Helix model. The emergence of a concise concept – the Triple Helix model – is the result of overlapping of works and considerations of Henry Etzkowitz and Loet Leydesdorff. The research on the connections between the industry and the sphere of science (Etzkowitz 2002) was connected with the long-term evolution of the means of communication and exchange of knowledge between the spheres (Leydesdorff 1995). Besides, the creation of the Triple Helix model was influenced by the works of C.U. Lowe, J. Schumpeter, R. Vernon, J. Sabato, M. Mackenzie, R.R. Nelson, and S.G. Winter (Lowe 1982, Schumpeter 1964, Vernon 1979, Sabato 1975, Sabato and Mackenzie 1982, Nelson and Winter 1982, Winter 1977). Much of the research on relationships, coexistence, mutual exchange and even support of spheres assumed an ideal cooperation.

Some works focused on the evolution of the model relying on simple but valid assumptions and cause-effect sequences (Abdrzak and Saad 2007, Zawdie 2008, Carayannis and Campbell 2009). In this way, however, the individual features of objects and spheres that occur in a diverse local environment are neglected. This article incorporates local features when presenting the concept of the given model.

The Triple Helix model is constantly gaining recognition throughout the world. In its classic version, it was composed of three spheres: business, science and public authorities. The necessity of cooperation between them resulted mostly from the type of economy – mainly capitalistic based on democratic values – as well as the willingness to accelerate the absorption, creation and

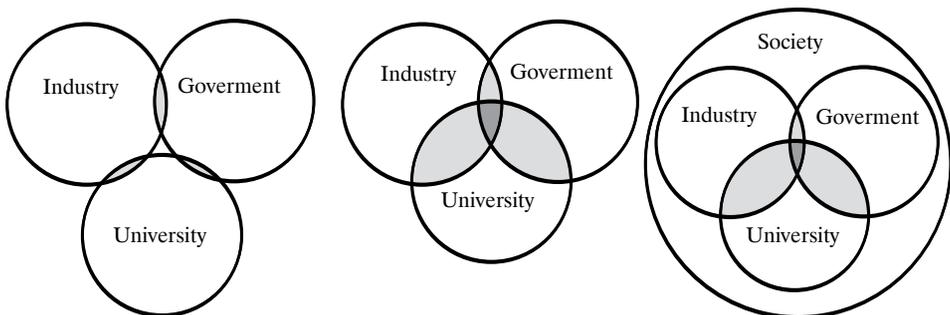
gathering of knowledge, which is considered to be the activator of development and growth processes. Universities play a significant role in this model. They are treated as places, where the knowledge is created and gathered. Due to the possessed research potential, they can shape innovations in a knowledge-based economy. However, it is not implemented automatically. This process requires transforming universities from institutions dealing only with teaching into entities connecting various departments: didactic, research and implementation. In the literature, entities of this type are called “enterprising universities” (Seliga and Sułkowski 2016).

The key element of the Triple Helix model is the fact that it does not only describe the three spheres but it also emphasizes relationships and fluctuation of roles of the particular actors (Jasiński 2000). In this situation, the research function of universities can be performed by enterprises, which form R&D departments composed of scientists and which are responsible for shaping innovation. The cooperation between science and public authorities can also prove useful as it may support the development of business by providing capital and innovation. Relations between representatives of science, business, and public authorities have different intensity, which ultimately influences the shape of the model. Each of the areas has other advantages, including the mass determining the potential in a given environment. In addition, there is a different saturation with institutions that connect representatives from particular spheres.

Figure 1 presents a shortcut of the Triple Helix model evolution: from bilateral relationships to the common space for the exchange of knowledge and innovation, and finally to the discovery of the external factor – the society, viewed from the perspective of the environment in which the trilateral relations occur.

Observation of various layouts between the three spheres, either in Polish and foreign cases, enabled the evaluation of the three separate models. The division results mainly from the varied potential of the particular spheres and relations between them.

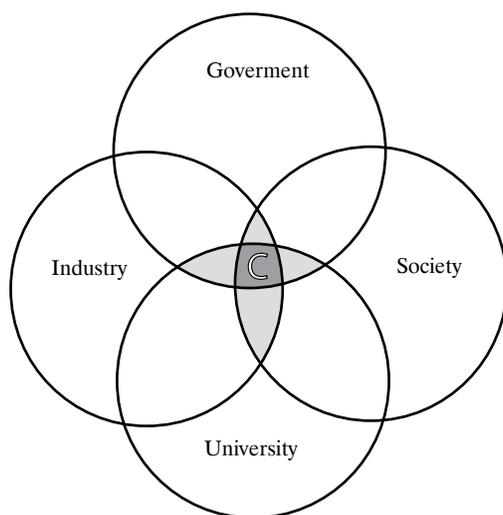
**Figure 1**  
**Evolution of the Triple Helix model**



In the first one, the public sector plays the key role. The way in which the three spheres are connected and the access to cooperation of the successive ones, e.g. the society, depend on various factors, including historical, economic, cultural or political conditions (Olechnicka and Płoszaj 2010). The structure assuming the regulated cooperation of science and business in the environment shaped by public authorities was present, among others, in the Soviet Union (Etzkowitz and Leydesdorff 2000). Restricted initiative on the part of universities and enterprises prevented a full utilization of their potential.

In the second approach, every sphere is independent and different from the others. The cooperation is based on equal partnership, which mainly results from the willingness to create innovation. Every sphere has only classic and basic tasks attributed. According to this model, universities are responsible for providing basic research and qualified employees; enterprises compete against each other in the network of market connections, and the task of public authorities is to solve current economic problems (Wątopek 2012).

**Figure 2**  
**The place of quasi-institutions in the Triple Helix model**



C – institutions such as: clusters, innovations councils, science and technology parks, associations and foundations for entrepreneurship.

Source: own elaboration.

The level of interest correlation between the three spheres is the subject of multiple research. The cooperation, its complexity and dependence between the spheres prove to be crucial for the increase in efficiency of the creation and diffusion of innovation. Currently, most countries try to support the activities to make the spheres penetrate one another. It happens in a natural manner, but the speed of those processes is still sometimes unsatisfactory. The common goal is to create a pro-innovation environment. More and more often, the functions of the

particular spheres overlap each other: enterprises participate in teaching programs and they deal with research and development activity; universities create e.g. incubators supporting the establishment and development of enterprises or spin-off companies. Moreover, the trilateral relations are being established that enhance regional development with the financial support of public authorities (Etzkowitz et al. 2007).

Subsequent international research seems to confirm that indisputable roles in the proper (effective) functioning of cooperation between representatives of the three spheres and society are played by various types of institutions, including clusters, interdisciplinary innovation boards or science parks (Ngui Kimatu 2016). Thanks to them, society ceases to be just an environment creating conditions for cooperation, and it also becomes a subject participating in creating and using the effects of other spheres (Figure 2).

At present, the model recognizes the growing role of the society in shaping the relationships between the spheres and highlights the significance of universities as places that generate entrepreneurship and also educate future administrative staff and researchers. They are able to accumulate knowledge from various fields and widespread it for the sake of people and innovations created by them. It is possible, provided that there is a strong research and development unit or university in the given administrative area. Otherwise, there is a gap whose closing depends on the relationship between particular spheres. The key aspect of the Triple Helix model is the innovation description. It cannot occur without the cooperation of the three sectors, which is defined as a set of specific, flexible and universal connections of enterprises, research and development institutions and the public sector (Etzkowitz and Ranga 2010).

## **2. Smart city concept and its development**

The concept of a smart city (Caragliu 2009) emphasizes the importance of investing in ICT infrastructure. The main goal, as in the case of the Triple Helix model, is to improve the quality of life of residents. An indirect goal is to increase the competitiveness of cities. The implementation of the most modern solutions in the field of communication and space management requires high quality social capital (Sauer 2012). Human capital gains potential when there are places in a given administrative unit that allow self-development and exchange of knowledge between representatives of particular spheres.

Recognition that human capital with its knowledge, skills and experience plays a key role in this concept is the first stage to implement the assumptions of smart cities (Augustyn 2013). The guarantee of the continuity of changes is the provision of financing, which in a long perspective will guarantee the improvement of the human capital quality. Cities must introduce technological innovations also by using the intelligent, innovative potential of their citizens. It is concentrated i.a. in units dealing with supporting entrepreneurship or creating links between

science and business. The development of the smart cities concept is the consequence of applying the assumptions of the Triple Helix model on lower administrative levels. Spontaneous creation of connections between the particular actors on the local level as well as support for those processes, with the concentration on the growth of knowledge within the society, shaped the new definition of pro-innovative relationships. Cities with favorable demographic trends gain the potential necessary to create innovation. The rising saturation of the environment with technology causes that the distances that until now have been reserved only for one of the actors are becoming shorter.

A smart city is a space mapped out according to regulations, where the degree of saturation with information and communications technology that enhance interactivity and efficiency of urban infrastructure and its elements is relatively high (Azkuna 2012). The utilization of technologies leads to the increase in the level of the spheres coexistence. It raises the level of the interests correlation and blurs the functional boundaries between them. In this kind of space, the society is able to influence the particular spheres on a much larger scale and also shape the strategy of further development by establishing conditions to form the bilateral and trilateral relationships between actors on the local market.

In order to call a city smart, it should fulfill, among others, the following conditions:

- people should make use of the gathered knowledge and continue to acquire more of it,
- there should be high efficiency of institutions and procedures in the creation, diffusion, adaptation and broadening of knowledge,
- the space is highly saturated with a broadband infrastructure and there is a great number of digital areas,
- e-trade is highly advanced, either when it comes to sales as well as consumption,
- there are extensive tools for a remote management of knowledge,
- there is a possibility to document the ability to create innovation, management and problem solving,
- there is a potential to solve problems that are non-linear, crucial, nonrecurring and different from the ones observed so far.

The occurrence of the above conditions allows to assume that, in the given area, the level of the spheres correlation is relatively high and the established mechanisms enable the almost unlimited diffusion of knowledge. The growing role of the IT and ICT technology and constantly greater utilization of robots in various areas of human life and branches of industry (WEF 2015) cause that the borders in the field of exchange of information and cooperation are also blurred. It is more and more difficult to speak about the spatial restriction of cooperation between the actors from the local or regional scene. Their evolution takes a new dimension that has not been observed up to now.

The evolution towards smart spaces is still proceeding. Only bigger urban centers are able to provide proper potential in order to develop fully in this way.

The spatial, administrative and knowledge resources located there in the form of science units (entities belonging to the spheres of education, research, development, e.g. universities and their scientists and students), together with business units (of various size and fields of activity), are integrated and can be directed by local authorities. The city of Białystok – the administrative capital of the Podlaskie Voivodeship – possesses this kind of character.

### **3. The implementation of the Triple Helix concept in Podlasie**

The assumptions of the Triple Helix model on the local level are implemented unevenly. It greatly depends on the following factors:

- the size of the center and the level of concentration of the particular actors,
- history, local traditions, entrepreneurship, knowledge,
- the level of development of the particular actors,
- previous and current activity of the actors.

The cooperation of the three sectors, understood as “adopting measures for the common goal, based on the identification with this goal, trust (...) and acting in the interest of all the participants” (Czarniawski 2002), becomes an end in itself. The basic task of the authorities of the Polish units of territorial self-government is to create proper conditions to enhance innovation leading to the intensification of local potential as well as social and economic development (Truskolaski and Waligóra 2015). However, it was not always the same.

Until the systemic transformations in Poland, which took place after 1989, the public sector played a decisive role in shaping the economic and social development. The private property and entrepreneurship were artificially limited. These were public entities which were mostly supported by the state. They had very low efficiency and the additional funds they gained mostly served to satisfy current needs and were not used for investments in order to develop. The same things happened in Podlasie.

In Poland, after the Second World War and after the communists came to power, it was assumed that the working class should have a decisive voice. The consecutive years were devoted to rebuilding and developing the state industry – most public funding was directed there. People focused on the potential measured by absolute values and not efficiency. What counted was the largest number of production facilities, employees etc. Higher education, especially outside the biggest centers, developed only in the last three decades, e.g. University of Białystok was established in 1997.

The system of governance and non-democracy of the governments caused that the citizens did not have an opportunity to shape the environment they lived in. This system limited the society’s creativity and led to the loss of knowledge and skills.

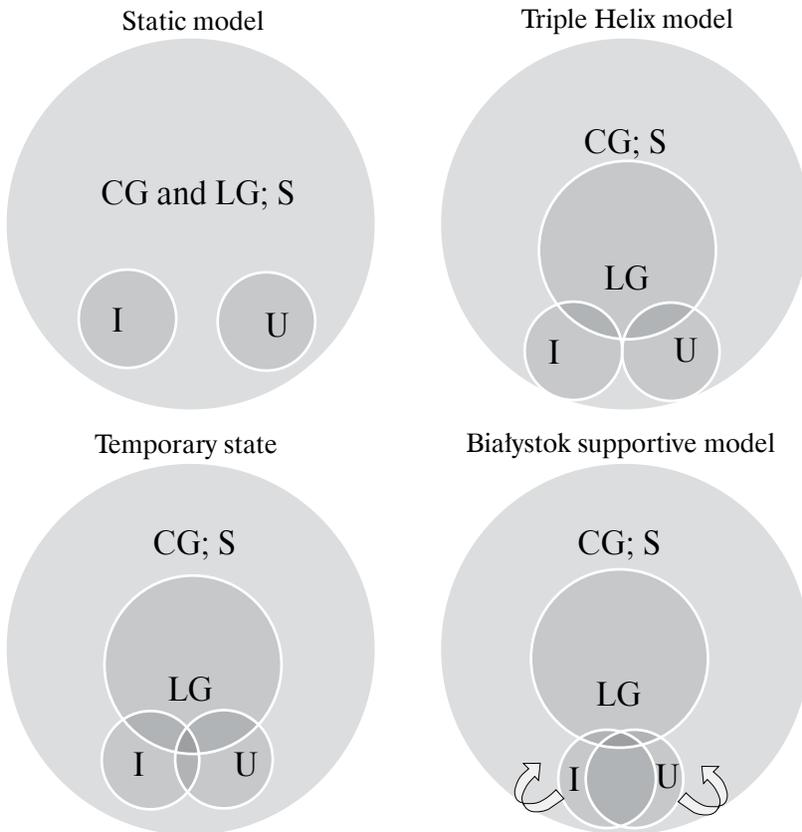
It was only the public sector that constantly had a decisive impact on the occurring changes. Local, regional and national authorities shaped the mutual re-

relationships according to the long-term strategies prepared from above. Only this sector, due to the advantage resulting from exercising power, could develop in such a way that enabled the increase in its potential.

In the last few decades, there has been a change in proportion between the particular spheres. Due to the democratization of politics, the citizens gained influence on the surrounding world. Private entrepreneurship and the inflow of foreign capital to the national market led to a very fast increase in Poland's economic potential. Higher education, as a result of noticing its role in building international competitiveness of the country, gained additional channels of funding, which influenced the constant improvement in the research infrastructure.

**Figure 3**

**The target point in Białystok authorities' policy in a short and long-time perspective**



CG – central government, LG – local government, S – society, I – industry, U – university.  
Source: own study.

The activities conducted in the second decade of the 21<sup>st</sup> century aim at switching to the 'support model', where public authorities would decrease their involvement in the processes of supporting and creating innovation. That is the reason why, at the beginning of the decade, there is so strong support from ex-

ternal operators and the creation of hybrid institutions, which are to become financially independent in the next years. Through the activities that are currently carried out, e.g. setting up institutions supporting the cooperation between science and business, the self-government is trying to switch to the ‘support model’. Local authorities want the relationships between business and science to become independent. The activities conducted in the first and a half of the second decade aimed at intensifying those relationships, creating the network of contacts and connections, and this process is coming to an end. Currently, there are also other spheres that begin independently to achieve their objectives with the use of the available infrastructure, e.g. in the Białystok Science and Technology Park.

#### **4. The Białystok Science and Technology Park as an integrator of business-science cooperation**

At the end of the 20<sup>th</sup> century and at the beginning of the 21<sup>st</sup> one, local authorities, while searching for new solutions to support development, decided to implement a plan based on integrating different environments, which would lead to gaining synergy from their cooperation. Moreover, activities aiming at enhancing entrepreneurship in the region were conducted, the research and scientific development at universities was supported and new investors were being searched for.

In the first decade of the 21<sup>st</sup> century, a comprehensive action plan was developed: the City of Białystok Development Strategy for years 2011–2020+. On one hand, the efforts to enhance the science sector were made, e.g. by supporting the University of Białystok in constructing its campus, helping other universities in expanding their scientific infrastructure, or by conducting soft activities – conferences, meetings for the enhancement of cooperation between the biggest universities in the region. On the other hand, the activities were carried out aiming at attracting capital from other parts of the country and from abroad, and more favorable conditions were created for the functioning of enterprises, e.g. by establishing the special economic zone – the place where the operating companies enjoy various privileges, among others, the lowest taxes. The aforementioned activities, were combined with various informative actions, e.g. conferences of ‘good practices’, aimed to attract and integrate the spheres of business and science. All this was connected with supporting the business-related organizations and establishing a hybrid institution – the Białystok Science and Technology Park.

The idea of creating the Science and Technology Park emerged before the City of Białystok Development Strategy for years 2011–2020+ was prepared. However, only in this document it was properly legally defined. The Białystok Science and Technology Park (BSTP) is the project implemented in the years 2008–2015 by the City of Białystok and co-financed from the resources of the European Regional Development Fund within the Operational Program of Development of Eastern Poland 2007–2013. The total value of the project was 167,741,884 PLN

and the funding constituted 87.86% of the eligible costs, that is 125,106,728 PLN (City Hall in Białystok 2016). An important role was played by funds from the European Union budget, which enabled the activation of the local innovative potential.

The Park is located in the direct neighborhood of the Suwałki Special Economic Zone as well as of universities, such as: the Białystok University of Technology, the Medical University of Białystok and the University of Białystok. This kind of location fosters the creation of space for science and business and strengthens relationships between them. Within the investment, two facilities were built (Technology Incubator and Technology Centre) with the total area of 13 000 m<sup>2</sup>. Besides, 23 adjacent hectares were provided with the proper infrastructure, which gives space for industry, production or services. The investment covered also the infrastructure adjacent to the Park and investment areas – the roads were built which improved communication and new infrastructure was created (City Hall in Białystok 2016).

The need for creating the BSTP resulted from, among others, the following factors: relatively high density of industry on the territory of Białystok (more than 34% of companies and almost 40% employees of the Podlaskie Voivodeship), advanced science and research sphere, higher education institutions with a wide educational offer compatible with the needs of the job market, limited financial capacity of the local scientific units in developing and implementing new technologies, fragmentation of numerous organizations supporting entrepreneurship and innovation, which led to duplication of their duties and low efficiency of their operations, difficulties reported by entrepreneurs in reaching the proper organization as well as a generally low level of innovation in those companies (Truskolaski 2013).

The Park functions as a separate organizational unit of the City Hall, in accordance with the adopted model assumptions regarding integration of the three spheres. Moreover, it possesses the Programme Council holding an advisory function for the BSTP authorities. It consists of experts from Białystok's universities, specialists from the preferred sectors and lawyers. The integration of the BSTP with science is fostered by the Think Tank composed of the so-called 'young scientists' – participants of doctoral studies under 35 years (Portal Innowacji 2015). The Park is thus a tool, which aims at integrating the activities of the three sectors within the common platform.

One of the key tasks of the BSTP is to support technology companies at every stage of their development as well as to generate new enterprises. The process of supporting incubation includes the services supporting entrepreneurship (City Hall in Białystok 2016). On 5 March 2018, there were 44 start-ups and 17 mature companies (over 3 years of activity, 7 professional laboratories) and 61 companies in the virtual office housed by the BSTP. 39 companies have successfully left it.

So far the Białystok Science and Technology Park has held numerous training cycles and workshops, conferences and competitions for students, graduates and businessmen. The BSTP was a co-organizer of events related to entrepre-

neurship, innovation, creativity, marketing, social media, and it established a permanent co-working space. In 2014, the BSTP conducted, among others, the following project: “Activating Innovation, Cooperation and Academic Entrepreneurship” as a result of which two attractive undertakings were formed: Centroom (co-working space) and Transferring Space (City Hall in Białystok 2016). The first one applies mostly to freelancers and allows them to enhance knowledge and use the available solutions. It motivates other people to set up or extend own business activity. The aim of the second one is to transfer scientific solutions to business and connect mutual expectations of the two sectors. In this way, research can be carried out for the needs of the private sector, which ultimately leads to the development of the region.

The Park possesses its own Technology Incubator, which supports innovative undertakings. Due to this, the highly skilled workforce in the region has the chance to succeed. The Park offers help to newly established enterprises, but also to the already existing ones, which need its support in implementation or development of innovative projects. This help, depending on its scope and entity, can be partially or fully covered (Białystok Science and Technology Park 2016). Additional incentives for joining this area can be the office space equipped with the most advanced technologies and vast spaces that are currently under construction next to the Park. A private investor, who appreciated the Park’s potential, decided to create a facility which should meet the needs of the developing companies (Strefa biznesu 2016).

Technology Center existing in the BSTP serves mainly to implement tasks connected with conducting service activity for the high technology sector and implementing tasks resulting from the participation of the Park tenants in R&D programs. Within the center, professional spaces were established suited for the current tenants: a molecular imaging laboratory, a laboratory for testing electromagnetic compatibility, a computer graphics laboratory, a 3D printing laboratory, a biomedical laboratory, a physical-chemical laboratory as well as an innovative laboratory which has the line for the production of sinters in MIM technology. Every tenant can therefore count on direct and material support, which is essential for developing innovative activity (City Hall in Białystok 2016).

Interest in the cooperation within the BSTP is constantly growing. Up to now, several contracts have been signed with representatives of the following sectors: information and communication, mechanics, automotive industry, industrial automation, electronics, advertising communication, medicine. The cluster initiatives would also like to participate in the Park’s development as they consider it to be the activator of development and innovation growth (City Hall in Białystok 2016).

The BSTP runs also many projects directed at students – the human capital potential that should be used in order to develop in the nearest future. It is stimulated in the Park by various types of entities, e.g. venture capital funds, seed funds, business angels and investors, as well as people who gained experience from other start-ups, or those who successfully launched their own product. Knowledge gained at university and professional work, combined with expert

knowledge and experience, boost creativity necessary to develop innovative ideas. These projects include: ‘Student in Transferring Space’, ‘Science Battle’ or ‘The starting platform for new business ideas – Hub of Talents’. Another interesting concept is the project of ‘Angels in Białystok’, which is directed at scientists, academics, businessmen with long-time experience, who are seeking support and practical knowledge necessary to multiply the idea (Białystok Science and Technology Park 2016). These are only some selected examples confirming the significance of this entity on the local innovation scene.

The implementation of the Triple Helix model in Białystok takes place with the participation of the Białystok Science and Technology Park. Local authorities still play a significant role in fostering collaboration. The establishment and current functioning of the BSTP allows to assume that the proximity of science and business will make those relationships independent. The self-government would shift from being a collaboration moderator to a partner supporting the activities of science and business on the explicit request.

## **5. The increase in innovation within the region**

Creating a space that allows the formation of innovative companies is not synonymous with an increase in environment innovation. Only diffusion of solutions and spontaneous creation of further incentives, the development of entrepreneurship among young people and the transfer of businesses outside from the areas of business incubation and support would allow for an increase in the environment innovation. Apart from the integration of the scientific community with the business and the support provided for the functioning of the two, it should be checked whether the establishment of the BSTP, despite the relatively short existence (launched in 2008; formally completed in 2015), has contributed to local and regional innovation. However, the innovation of the administrative units in the municipality or the voivodeship consists of much more than the number of new innovative enterprises.

During the conference of innovative regions of the world in Seattle in 2008 benchmarking of the nine most innovative regions in the world was discussed (IRBC 2016). Areas that determine the occurrence of an innovative region were identified as:

- education,
- entrepreneurship,
- environment (in the sense of atmosphere for the partnership and for the emergence of innovative projects).

Innovation is much more than modern technologies. It is also art, culture and heritage, services and customer service, environment, education, multiculturalism and what was defined as the energy of the place (Olesiński 2009). The need for an extensive treatment of innovation has been stressed in the statement of

the EU Commission issued in September 2006 (Commission of the European Communities 2006). This document highlights the role of education as the main factor of innovation, with a view to promote talent and creativity from an early age. Therefore, there are many elements that affect the long-term innovation in the region.

Numerous universities existing in the city, including the three largest ones (in terms of number of students and academics): University of Białystok, Białystok Technical University and the Medical University of Białystok, support the BSTP in the process of creating an environment favorable for innovation. These three universities located in Białystok educated over 77% of all students in the Podlaskie Voivodeship in 2016 (GUS 2017b).

After the administrative reform conducted in Poland in 1999, which established 16 voivodeships, the Podlaskie Voivodeship (capital: Białystok) has launched actions to enable the development of entrepreneurship and strengthen science (Dz. U. 1998). In 2000, Podlaskie Voivodeship was classified in the 15th place in the innovation ranking of Polish regions, while in 2006 it was ranked number 10 (Nowakowska 2009). In order to boost this development, it was decided to develop the infrastructure, the deficiency of which was particularly evident in Eastern Poland (macro-region composed of the Podlaskie, Lubelskie, Warmińsko-Mazurskie, Podkarpackie, and Świętokrzyskie voivodeships). In the ranking of innovations prepared by Millenium Bank, in terms of expenditure on R&D in relation to GDP, the Podlaskie Voivodeship took the 7th place. This indicator was higher than, for example, in Zachodniopomorskie, Wielkopolskie and only slightly lower than in Dolnośląskie (Maliszewski 2017). Current and future development depends to a large extent on the amount of R&D expenses and long-term investment financing.

Supporting business and science by the local authorities has led to an increase in the intensity of cooperation. Eventually, this translated into increasing enterprise innovation. In 2008–2010, 18.2% of Podlaskie industrial businesses led innovation activities (the most in Podkarpackie – 21.8%, the fewest in Lubuskie – 16%). In the years 2012–2014 there were 18.7% of such enterprises in the Podlaskie Voivodeship (the highest share of such enterprises was noted in Lower Silesia – 22.1%, the lowest one in Świętokrzyskie – 14.2%). In the years 2014–2016, the number of innovative industrial enterprises in the Podlaskie Voivodeship increased to 20.6% (the highest number of such enterprises was seen in Małopolskie Voivodeship – 23.7%, the lowest one in Warmia and Masuria – 14.8%). Accordingly, in the case of service enterprises, in 2008–2010 there were 9.2% innovating firms in the Podlaskie Voivodeship (the most in Mazowieckie – 16.3%, the least in Podlaskie and Warmia and Masuria – 9.2%). However, in 2012–2014 the share of the service companies engaged in innovative activity in the Podlaskie Voivodeship was 10.6% (the most in Lubelskie – 17.5%, the least in Warmia and Masuria – 4.4%). In the years 2014–2016, the number of service enterprises active in innovation dropped to 6.3% (the largest number of such companies was in Lubelskie Voivodeship – 23.6%, and the smallest one in Warmia and Mas-

uria – 4.9%). In the overall ranking for the period, the Podlaskie Voivodeship moved from the 15th/16th position to the 9th place, which can be considered to be a significant improvement (GUS 2012, 2015, 2017a).

The increase in innovation in the region and the municipality can also be assessed by the increase in the number of enterprises with departments that are considered innovative or influence the development of innovation. According to the Polish Classification of Activities (PKD 2007), these are: manufacture of computers, electronic and optical products, activities related to software and consultancy and related activities, research and development. In the municipality of Białystok or within a 12 km radius from the BSTP headquarters (besides the additional spaces owned by the Park and located in other parts of the city), the number of companies providing innovative services and manufacturing products according to the above categories increased by 155%, 215% and 300% in 2009–2015.

## Summary

The article presented an analysis of the current situation of Białystok and the strategies implemented during the latest three decades, which enabled the implementation of the Triple Helix assumptions and are presently supporting the establishment of a smart city. Furthermore, the research was made to assess the changes in innovativeness of the region after creating the Białystok Science and Technology Park.

Little attention was paid in the literature to hybrid institutions supporting the collaboration of the three spheres (Bellgardt et al. 2014). Their constantly growing number and the existing support institutions such as the BSTP, set up in order to increase connections and foster collaboration between business and science, enable the creation of new, innovative solutions which can be applied in urban areas. IT and ITC solutions foster the development of smart cities. Therefore, the objectives of local authorities are ultimately linked with the objectives implemented by other spheres.

The effect of functioning in the city of such an initiative as BSTP is the increase in the number of enterprises from innovative industries. Next to the BSTP, new office buildings are being created, which – after a period of incubation of enterprises within the BSTP – will provide them with space for further development. Both enterprises participating in the Park and those which are not yet associated with it willingly locate their headquarters in the adjacent infrastructure. Enterprises from the whole region from sectors with a lower level of production advancement seek opportunities to establish cooperation with entities located in the BSTP zone. Some of them try to transfer part of their activities to investment plots located in the same district of the city. Such accumulation of companies from various industries boosts the exchange of information and cooperation in

the field of production development. In addition, the BSTP mission is a further expansion. By developing, expanding the scale of activity, tasks are also disassembled. Nowadays, education through play is also an important aspect. According to the Triple Helix model, the BSTP leads the society to creatively change the reality.

Experience in Białystok related to the establishment of an institution supporting the combination of scientific knowledge with the activities of enterprises and self-government can be an example for other municipalities. The case study of Białystok can be used to create a model solution of the basic structures for cooperation between science, business and public authorities. The article is an introduction to further research on the practical dimension of the development of the TH concept.

The article began with the statement that functioning of the Białystok Science and Technology Park intensifies the collaboration of the three sectors in the city of Białystok and generates conditions necessary to implement the smart city concept. The presented process of modification of the power structure after 1989 between the local representatives of the three spheres allows to assume that with the support of business-related and hybrid institutions, Białystok's competitiveness and the quality of citizens' life will improve. Białystok is becoming a competitive city according to the 21<sup>st</sup> century spirit of smart and sustainable development. The above mentioned objectives of sustainable development seem easier to achieve when the cooperation within the Triple Helix model is being ensured (Busłowska 2016).

The development of Białystok – the regional growth center, leads to a rise growth in innovativeness and entrepreneurship. This translates into a number of business and business-related initiatives, which is increasing every year. The solutions developed in the BSTP find application in the nearest space. It serves the objective of implementing the assumptions of the Triple Helix model. The development of one branch of industry contributes to the development of other branches, but it also improves the quality of life of the city's citizens. Thus, this process is highly advantageous.

Further works of the self-government aim at making the relationships independent and at implementing technologies that will let Białystok join the category of a 'smart city'. The first element of this system was the implementation of the system of managing traffic and public transport, which adjusts to road conditions and traffic intensity (City Hall in Białystok 2016). In this way, the solutions created on the edge of the other spheres are verified in real conditions.

Enterprises established in the BSTP and in the nearest surrounding are highly innovative. Solutions created in them can be implemented to create a smart city. Thus, the smart city concept in Białystok is moving into a new phase: from the period of absorption of external technical solutions to producing its own.

Smart spaces aim mainly at improving the quality of the citizens' lives. It should be noticed that since the time of the Triple Helix model's implementation and together with the development of the smart city concept, Białystok is very

positively assessed by its inhabitants. In the “Eurobarometer” ranking, Białystok constantly holds very high positions in Europe and the highest in Poland. It is a great success that cannot be undervalued.

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## THE ROLE OF THE BIAŁYSTOK SCIENCE AND TECHNOLOGY PARK IN IMPLEMENTING THE SMART CITY CONCEPT

### Abstract

The article contains a critical analysis of the Triple Helix model – both on a theoretical plane and in the context of its application to the functioning of the Białystok Science and Technology Park (BSTP). The authors stress that the Triple Helix model should be adjusted to local conditions. Its implementation requires modifications that take into account both the current state and future goals, which should ensure socio-economic development of the city.

The BSTP, founded by the local self-government, plays the key role in the city development. While being a hybrid institution, it creates proper conditions to generate innovative undertakings which are necessary for the implementation of smart city concept in Białystok. The authors maintain that Białystok is at the stage of integrating science and business, but ultimately the public sector should restrict its activity to ‘support on demand’. Current success of local companies in the STP is a sign of effective implementation of the smart city concept, which is beneficial for the citizens.

**Keywords:** Triple Helix, hybrid institutions, science and technology parks, smart city, Poland

**JEL:** H70, N94, O12, O31, P48

## ROLA BIAŁOSTOCKIEGO PARKU NAUKOWO-TECHNICZNEGO WE WDRAŻANIU KONCEPCJI „INTELIAGENTNEGO MIASTA”

### Streszczenie

Artykuł zawiera krytyczną analizę modelu Triple Helix, prowadzoną zarówno od strony teoretycznej, jak i praktycznej – w kontekście doświadczeń związanych z funkcjonowaniem Białostockiego Parku Naukowo-Technicznego. Autorzy uważają, że model Triple Helix powinien być dostosowany do warunków lokalnych. Jego wdrożenie wymaga modyfikacji uwzględniających stan bieżący i kluczowe cele, które mają zapewnić rozwój społeczno-ekonomiczny miasta. Hipotezę weryfikowano na podstawie przypadku Białostockiego Parku Naukowo-Technologicznego (BPN-T).

BPN-T, utworzony przez samorząd lokalny, odgrywa kluczową rolę w rozwoju miasta i jako instytucja hybrydowa tworzy odpowiednie warunki do tworzenia innowacyjnych przedsięwzięć, niezbędnych do wdrażania koncepcji *smart city* w Białymstoku. Autorzy twierdzą, że Białystok jest na etapie integracji nauki i biznesu, ale sektor publiczny w przyszłości powinien ograniczyć swoją aktywność do doraźnego wsparcia. Obecny sukces przedsiębiorstw zlokalizowanych w BPN-T świadczy o pomyślnym wdrażaniu koncepcji „inteligentnego miasta”, która przynosi korzyści mieszkańcom.

**Słowa kluczowe:** Triple Helix, instytucje hybrydowe, parki naukowo-technologiczne, „inteligentne miasto”, Polska

**JEL:** H70, N94, O12, O31, P48

## РОЛЬ БЕЛОСТОКСКОГО НАУЧНО-ТЕХНОЛОГИЧЕСКОГО ПАРКА ВО ВНЕДРЕНИИ КОНЦЕПЦИИ «УМНОГО ГОРОДА»

### Резюме

В статье содержится критический анализ модели Triple Helix, как в теоретическом, так и практическом аспекте, на примере опыта функционирования Белостокского научно-технического парка. Авторы считают, что модель должна быть адаптирована к местным условиям. Ее внедрение требует модификации с учетом текущего состояния и ключевых целей, призванных обеспечить общественно-экономическое развитие города. Это гипотеза была проверена на примере Белостокского научно-технического парка (BPN-T). BPN-T, созданный местным самоуправлением, играет ключевую роль в развитии города и, являясь гибридным институтом, создает соответствующие условия для возникновения инновационных предприятий, необходимых для внедрения концепции *smart city* в Белостоке. По мнению авторов, Белосток находится на этапе интеграции науки и бизнеса, а публичный сектор в будущем должен ограничить свою активность до случаев временной поддержки.

Наблюдающийся успех предприятий, находящихся в BPN-T, свидетельствует об успешном внедрении концепции «умного города», которая приносит пользу жителям.

**Ключевые слова:** Triple Helix, гибридные институты, научно-технологические парки, «умный город», Польша

**JEL:** H70, N94, O12, O31, P48