

# University Science Parks as an Innovative Tool for University-Business Cooperation

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**Abstract:** Collaboration between universities, business and government is important in creating innovation, but often they face barriers which block the successful cooperation among institutional spheres. To improve and strengthen collaboration and overcome existing barriers were created hybrid organizations (like university science parks, research centres or incubators) to address innovation blockages. With the growing popularity of this tool among regional policy makers, there is a need to specify their roles and functions in regional innovation systems. The main goal of our paper is to examine the contribution of university science parks and research centres in Slovakia, which were built thanks to financial support from European Structural and Investment Funds (ESIF). University science parks (USPs) and research centres (RCs) are tools for connecting the university, industry and government sector in a Triple helix framework. They create a suitable space for generating innovation with existing resources at universities, research institutes, research departments of companies and governments, and improve them through mutual interactions. We applied the method of quantitative research – an online questionnaire survey complemented with interviews, which we used to collect basic data on all science parks in Slovakia. The key question in the article is whether research infrastructures represent effective investment with long-term sustainability. We evaluated the current functioning of the parks in terms of fulfilling the functions that contribute to innovation creation, because quality and modern infrastructure is a prerequisite for the implementation of research, the results of which have a high development and innovation potential. We found that the research infrastructure doesn't perform the required functions, which were declared during their creation. The main barriers to development include insufficient funding for research, technological infrastructure and long-term financing of professional staff. Unclear conditions for the continued operation of parks and uncertain position of government support shows that these investment projects financed by the European Funds are not independently viable after the end of the sustainability period.

**Keywords:** innovation, university science parks, cooperation, enterprises

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## 1. Introduction

The competitiveness of countries and regions in sustainable growth is based on innovation and technology which depends to a large extent on the ability to create an attractive infrastructure environment that supports interactions between universities and industry (Battelle, 2007). The activities of universities have increased significantly, the main changes can be observed in joint activities with companies such as research projects, contract research and activities to support innovative entrepreneurship. Universities thus help to establish companies through their university incubators or science and technology parks (Blažek and Uhlíř, 2011). The level of technical infrastructure has qualified by human resources, a basic condition for the quality of research activities.

According to several international statistics (such as European Innovation Scoreboard or Community Innovation Survey by EU), Slovakia has been long-term on the last stages of the EU countries in terms of comparative evaluations of research and innovation results. The Triple helix model points to the increasing and necessary overlap of activities between universities, government and the private sector. There are many barriers that block successful overlapping activities and mutual cooperation between actors. Within the Triple helix model, it is possible to create independent hybrid organizations at the intersection of overlapping activities, which can be one of the solutions to innovation blockades (Champenois and Etzkowitz, 2018).

Observing European research and development trends, we see that focusing on creating European Research Area and intensifying the research base is an increasing priority. Success in European research means a high concentration of human and financial resources, strong background need to connect specialized workplaces with a focus on interdisciplinary research (Brzica et al., 2014). University science parks (USPs) and research centres (RCs) are one of the hybrid organization tools for connecting the academic and private sectors (Champenois and Etzkowitz, 2018). Over the past two decades, USPs been a continued source of interest for academics and policy makers due to their potential to aid innovation (Messina et al. 2022; Nieth and Benneworth, 2020). They create a suitable space for creating innovation using existing resources

at universities, research institutes, research departments of companies and governments, and improve them through their interactions. On the other hand, in addition to identify the strengths, benefits and motivating factors, it is necessary to focus on the barriers and weaknesses of joint innovation activities that prevent mutual cooperation between the actors of the Triple helix model.

The present paper examines the position of USPs and RCs in Slovakia. The key question that this article will address is whether research infrastructures represent effective investment for active collaboration between actors with long-term sustainability. We have tried to evaluate the current functioning in terms of fulfilling the functions that contribute to strengthen university-business cooperation, because quality and modern infrastructure is a prerequisite for the implementation of research, the results of which have a high development and innovation potential.

## **2. Theoretical framework**

University Science Parks and Research Centers represent a special type of science park in which universities offer facilities for researchers on the development processes of projects with market potential. If a regional development entity, government agency, developer, or global technology company establishes a park in partnership with a university, it is defined as USP. The primary goal of this interconnection of university research parks for tenants is some form of access to university resources (knowledge, talent, infrastructure equipment), which is expected for further regional economic development. There are more added values for universities – facilitating the commercialization of university research, attracting and funding excellent researchers, increasing publishing activities and creating patents (Link and Scott, 2003). According to the Association of University Science Parks (AURP, 2021), the main idea is to generate, attract and maintain research institutions and talents in line with sponsoring research institutions, which include universities, public and private research laboratories. Information flows from academia to the business sector are rapidly taking place in geographically close regions and they are an essential tool for creating innovation (Alegre et al., 2019). At the same time, they bridge the gap between the supply of universities and the private sector on the demand side, requiring the knowledge and expertise of universities (Leyden et al., 2008). They are also seen as a solution to complex political and economic regional problems in society, such as industry (Autio and Klofsten, 1998), in addressing the lack of commercialization of publicly funded research (Nowotny et al., 2001) or the lack of new innovation in the market. Universities expect commercialization their research and secure funding for more.

Almeida et al. (2020) show that science and technology parks are presented as a panacea for countries to catch up and accelerate the costly processes of structural changes. Globally, successful examples such as Silicon Valley, Cambridge or Grenoble have led to a boom across whole Europe by promoting universities or regional development agencies. They have become an element of the operationalization of regional innovation policy (Vasquez-Urriago et al. 2016, Guadix et al. 2016). However, in areas with insufficient R&D capabilities, these investments have proved to be very controversial. A strong focus on science in regions where companies are weakly linked to universities and the small technology market has led to inefficient results. Developed regions have built regional innovation systems on international context, R&D activities also rely heavily on endogenous initiatives (Meyer-Krahmer and Reger, 1999). Less developed regions face problems of lack of visibility and attractiveness due to lower income and technological levels. Although publicly managed R&D with investment in higher education institutions, what has enabled them to develop human capital and excellence in several scientific domains. USPs and RCs can contribute to increasing the external visibility and potential of the region and to attracting research, development and technology centres of transnational companies.

Although the literature is lightly more focused on developed and rapidly developing regions, the unfavorable results of various science parks have highlighted the need to balance the perspective of scientific pressure with considerations of demand. If the return on R&D needs to be maximized, especially in public R&D, Watkins-Mathys and Foster (2006) argue that policy makers and managers need to pay more attention to business. Therefore, it is necessary to emphasize the possibilities focused on the ability to attract external companies. Many European regions are making significant progress in subsidizing technology inputs, but they still lack a real innovation system because the interactions between academic research outputs and the technological activities of existing firms are weak. Science parks can be seen as a major contributor to the consolidation of regional innovation systems and act as a major impulse for structural change (Hobbs et al., 2017). To make

science parks successful, they should integrate design functions into the support of university products, attracting and grouping external R&D initiatives from transnational companies, but also from public and non-profit institutions (Almeida et al., 2020).

With the growing popularity of this tool among policy makers, it was necessary to specify their roles and functions in regional innovation systems (RIS). The regional approach is emphasized mainly in relation to the importance of geographical proximity and maximizing synergies between actors. At the same time, it emphasizes the need to strengthen cooperation and create innovation networks. USPs and RCs actively contribute to RIS concepts. If the park is effective, it will be at the heart of the RIS building process and play a key role in providing certain functions that the innovation system must supply (Table 1). They also contribute to the application of strategic R&D activities and the creation of knowledge and expertise. In addition, to attracting other external companies, there may also be an active grouping of companies and other institutions in the region and thus participate in their development. Edquist (2005) considered 10 functions that cover several areas – R&D, competence institution building, new products, identification of system needs, creation of organizations, innovation networking, incubation activities, financial resources and cooperation relationships. Almeida et al. (2020) also refers to Edquist’s identification of functions in his research which considers them appropriate in terms of scope of UVP competencies.

**Table 1:** Functions and indicators of URPs and RCs with contribution in RIS

<b>FUNCTION</b>	<b>CONTRIBUTION TO RIS</b>	<b>INDICATOR</b>
<b>Knowledge creation – University R&amp;D</b>	Creation of technological opportunities	Own research
<b>Knowledge creation – Business R&amp;D</b>	Facilitating the access to technological inputs	Common research with enterprises, contract research
<b>Technology transfer</b>	Technology transfer and interactive learning, STPs can promote a market for knowledge and reduce transaction costs	Transfer technology offices, patent office
<b>Networking</b>	Joint location of companies in the region	Cooperation with enterprises/sectors
<b>Creation of new firms</b>	Technological opportunities and its transformation into economic opportunities.	Incubators and projects supporting business, business consulting
<b>Clustering</b>	As an attractor for foreign firms that seek technological inputs for their R&D activities.	FDI
<b>Business support services</b>	Provision of business support services within an STP fosters business sophistication for newly created firms. Business consultants are more aware of technological aspects.	cooperation with venture capital funds
<b>Specialization</b>	High degree of specialization for one activity.	Specialized professional workplaces
<b>Common infrastructure</b>	STPs generate some agglomeration economies by the existence of common infrastructures and amenities. High quality, low building construction ratio.	Renting of business premises and devices to extern institutions
<b>Community involvement</b>	Local or regional governments and external nonprofit agencies make the STP a node of the RIS.	Collaboration with regional partners (such as regional governments, non-profit org ..)

Source: Edquist 2005, Almeida et al., 2020

### 3. Methodology

Other authors evaluate the measurement of impacts and results of USP performance by different methods and it is not precisely determined which tool should be used / which is correct for evaluating implemented activities (Squicciarini 2008; McCarthy et al. 2018). The problem of a small quantity of theoretical knowledge about USPs point to different strategies for their conceptual solutions (McCarthy et al., 2018), as they may differ in the focus of their activities, research methods or role in the regional innovation systems.

The literature points to the heterogeneity of methodological approaches to research implementation. In most cases, the authors apply qualitative research methods. They approach either case study (Park 2002, Albahari et al. 2013, Etzkowitz a Zhou 2018, Albahari et al. 2019, Cadorin et al. 2019), semi-structured interviews or questionnaire surveys (EC 2014, Lis a Romanowska 2018, Balog 2019, Olvera et al. 2020). Indicators assessed

in the studies include, for example - linkages with universities, infrastructure area, staff numbers, specialization, total R&D expenditure, provided services, number of companies established in parks, networking, establishment of a technology transfer office, number of patents and publications, innovation results, revenue or internationalization (Guadix et al. 2016, McCarthy et al., 2019, Almeida et al. 2020). The European Commission also used several basic criteria/indicators in the evaluation, such as park area, number of host companies or number of employees (EC, 2014). Based on the selected indicators, we evaluated their significance in Slovakia through a questionnaire survey.

Given the main objective of the parks, which is to support innovation, it is necessary to correctly determine the appropriate evaluation parameters. We conceived our submitted research similarly to the research that was carried out. We applied the method of quantitative research – an online questionnaire survey, which we used to collect basic data on all USPs and RCs in Slovakia. As part of the survey, we contacted all 14 USPs/RCs to whom we sent online questionnaires. We received fully completed questionnaires from 7 subjects, so our research had a 50 % return. We realized the questionnaire survey took place from April to June 2021 and consisted of closed and open questions. The questionnaires were structured into several areas: basic information, evaluation of state support and support mechanisms, barriers to further development, activities and services implemented in USPs/RCs, cooperation with external partners and research results. As we focused more on the evaluation of USPs/RCs functions in the region in our paper, the results describe 14 activities and services that are currently underway in comparison with those that the individual entities plan to implement in the future. We also divided them into 4 areas: research (own, contracted, joint with companies), rent of premises and equipment, professional advisory services and consultations, cooperation (with companies, other actors at the regional and international level, with venture capital funds). In the next steps of our research, we will plan to address selected subjects through interviews.

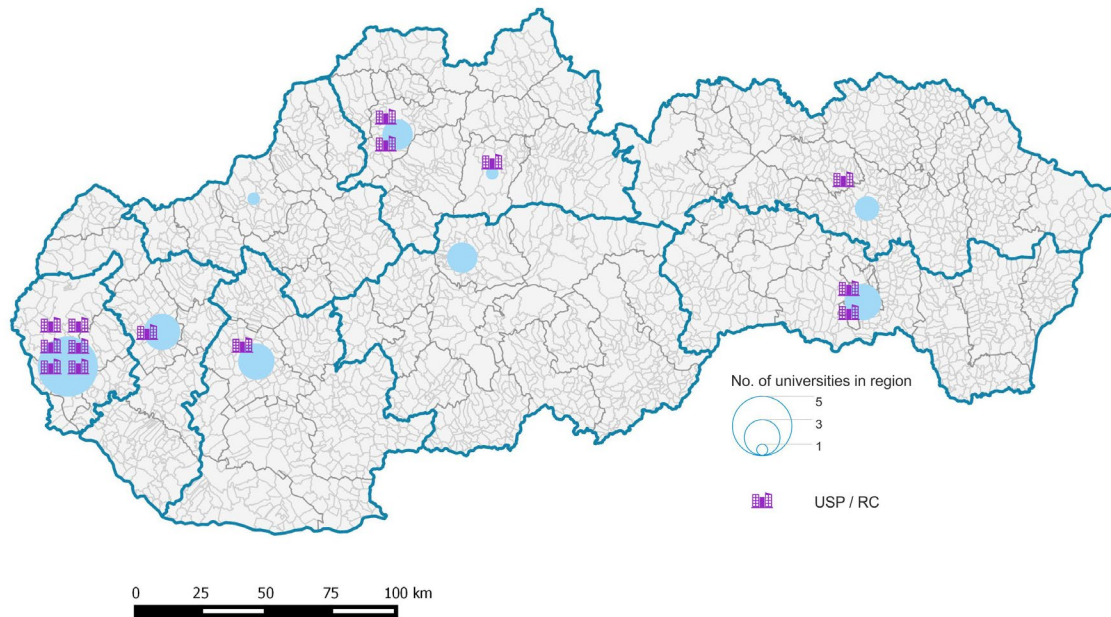
#### **4. Results and discussions**

In the V4 countries, many public and private R&D institutions had problem with the limited capacity of research facilities, insufficient material equipment, brain drain or lack of specialized staff and cooperation with private sector. Similarly, it was case of Slovakia too, because universities had not had experience with active cooperation, entrepreneurial activities, and R&D development. The lack of practical experience and financial resources for setting up R&D infrastructure had not created opportunities for the implementation, integration and support for university-business cooperation.

The implementation of USPs and RCs projects began in the mentioned programming period 2007-2013 within the operational programme Research and Development. The Ministry of Education, Science, Research and Sports as a budgetary authority announced calls for demand-oriented projects entitled "Building university science parks and research centres". The projects were mostly implemented as consortium projects of several organizations, which made it possible to support the networking of public R&D organizations and improve specialization processes (Jakab, 2020). A total of 14 strategic research and development infrastructure projects were supported. The purpose of the challenge was to create USPs and RCs, composed of academic institutions and possibly also with economic entities, which will be equipped with modern research infrastructure, and whose results of research and/or development will be: qualitatively at the international level, applicable in practice and linked to the needs of key industries in Slovakia (MŠVVaŠ SR, 2012). The main aim was to strengthen the innovation environment by promoting cooperation between academia and the private sector and the subsequent commercialization of research results. In total, projects were supported with more than 400 million €. Nevertheless, the project implementation dates were extended to the 2014-2020 programming period and divided into two phases. The original budget of individual projects was adjusted in the amendments to the contracts, which reduced the total amount of allocated funds to 429.63 million € (NKÚ, 2019).

The established USPs and RCs are located mainly in the Bratislava region (6), Žilina region (3) and Košice region (2), one project in Trnava region, Nitra region and Prešov region and none in Trenčín region and Banská Bystrica region. The highest concentration of USPs and RCs is in the capital city Bratislava, due to its strategic location, which intensively opening up to the business and innovation environment. Due to the fact that almost half of these entities are located in the Bratislava region, the level of services and their functionality for regional innovation systems is much higher. A relatively well-developed network of universities, research institutes connected to the newly built research infrastructure that offers several advantages for potential

cooperation with other partners in the region. The Bratislava Region is also home to the most of Slovak public universities (5) and the Slovak Academy of Sciences (Figure 1).



Source: Own elaboration based on information about each USP/RC and university

**Figure 1:** Regional distribution of universities/USPs/RCs

One of the functions that USPs and VCs contribute to the development of regions is knowledge creation. It is based on two levels - the first is the creation of knowledge at university level, which is represented by the university's own research. The second level assume the role of knowledge creation in cooperation with business entities through joint and contractual research with external companies. The results of our research show that all USPs and RCs have carried out their own research since their inception. About half are already conducting joint research with companies and contract research now, and they plan to do in the future. Sharing of premises and equipment to external institutions in the region is currently carried out by only one entity. About 71 % of respondents plan to carry out this activity in the future (Table 2).

The concept of regional innovation systems emphasizes the importance of networks as factors influencing innovation performance. The innovation networks mean the accumulation and exchange of knowledge or the development of new ideas between organizations (Žitek and Klimová, 2016; Powell and Grodal, 2005). Innovation network activities include the creation, combination, exchange, transformation, absorption, and use of resources through a wide range of formal and informal relationships. More than half of the entities (57 %) indicated that they use forms of networking with other partners. Only 29 % entities currently carrying out cooperation with non-business entities (local governments, n.o. and others), 71 % plan this activity in the future, 71 % subjects already cooperate with foreign partners.

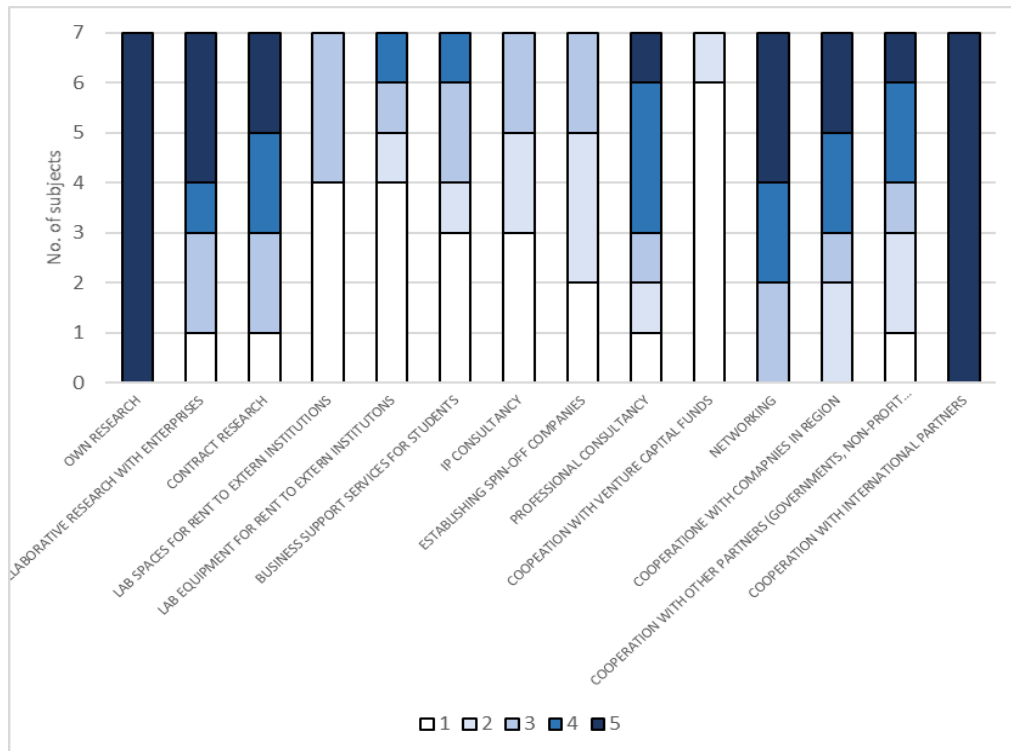
**Table 2:** Realization of activities in University Science Parks and Research Centers (% of all responses)

	ONGOING	PLANNING
OWN RESEARCH	100	100
COLLABORATIVE RESEARCH WITH ENTERPRISES	57	57
CONTRACT RESEARCH	43	71
LAB SPACES FOR RENT TO EXTERN INSTITUTIONS	14	71
LAB EQUIPMENT FOR RENT TO EXTERN INSTITUTIONS	0	71
BUSINESS SUPPORT SERVICES FOR STUDENTS	14	43
IP CONSULTANCY	29	29
ESTABLISHING SPIN-OFF COMPANIES	0	86

	ONGOING	PLANNING
PROFESSIONAL CONSULTANCY	71	71
COOPERATION WITH VENTURE CAPITAL FUNDS	0	43
NETWORKING	57	57
COOPERATION WITH COMPANIES IN REGION	57	57
COOPERATION WITH OTHER PARTNERS (GOVERNMENTS, NON-PROFIT ORG, ...)	29	71
COOPERATION WITH INTERNATIONAL PARTNERS	71	71

Source: Based on own elaboration

Due to the increasing business activity of universities, only one entity provides business counseling for its students with starting business ideas. The existence of business support funds is still low. Not a single entity cooperates with venture capital funds, 43 % plan to do so in the future. The establishment of spin-off companies is also only among the planned activities of almost all entities. Only one entity (14 %) provides business counseling for students, two entities (29 %) provide intellectual property counseling. However, interesting findings of the questionnaire survey illustrate Figure 2. In terms of the importance of activities, there are activities in the field of business consulting, establish of spin-off companies, rental of premises and equipment, or cooperation with venture capital funds are described by entities as less to least important (except own research) and cooperation with foreign partners. These activities are necessary to directly support start-ups and the establishment of spin-off companies for university students. Intellectual property advice is also beneficial for researchers who will gain the necessary knowledge to deal with their patents or inventions. As illustrates Figure 2, the significance of activities is different. The most important are own research and cooperation with international partners. On the other side, the least important are activities and services like cooperation with venture capital funds or renting laboratory spaces and equipment.



Source: Own elaborations

**Figure 2:** Evaluation of the significance of activities in University Science Parks and Research Centers (1-least important, 5-most important)

Through the agreement on the provision of non-repayable financial contribution, Slovak public universities and the Slovak Academy of Science were committed to the sustainability of the USPs. They meet this condition with difficulty, especially their capacities. However, in the area of EU Funds is the lack of R&D funding does not allow the development of parks to such an extent as to increase the chances of gaining support in the

European science area after the sustainability period of projects (NKÚ, 2019). The original calls intended to focus on supporting the innovation environment, particularly linking academia and business with quality research results with an international reach, with modern and high-quality infrastructure. But the reality hampers many obstacles, problem areas, and unfulfilled goals. According to the original intention of the call, the USPs and RCs projects were focus on supporting the international innovation environment, especially on connecting the academic and business environment with quality research results with an impact also thanks to a modern and high-quality infrastructure. However, the reality shows several obstacles, problem areas, and unfulfilled goals. However, almost 71% of entities perceive state support as bad. The biggest barriers are insufficient funding for research, infrastructure, and staff. Other barriers are legislative obstacles, outdated or missing infrastructure for specialized research, excessive administrative burden, weak cooperation with other research institutions, or lack of cooperation on international projects and grants. Unclear conditions for USPs and RCs after the end of the sustainability period are the results of persistent and unresolved problems with operability of investment projects.

## **5. Conclusion**

EU considers that research, development and innovation are favourable strategic factors for growth to boost the European economy. Research Infrastructures represent the primary tools to fill the scientific and technological gaps with regards to other international. Government support could play a key role in achieving scientific progress, technological advancement and knowledge transfer. The process of building and operating a successful science park is extremely costly not only in terms of financial and human capital, but also with regard to time and management. These types of research infrastructures have an important integration role, as they allow the concentration of different research capacities, even with international involvement in one place. Thanks to EU funding, top research infrastructures have been built in Slovakia and bring knowledge society actors. In the whole world, USPs and RCs are a successful tool for connecting the academic and private sectors, where interactions between universities, the private sector and government take place.

In conclusion, in this paper we pointed out the position of USPs and RCs based on the definition of their functions in regional innovation systems. We tried to evaluate the importance and position of USPs and RCs in Slovakia as a new phenomenon, which was co-financed by the European Structural and Investment Funds. First of all, we wanted to point out the inefficiency of using and actual functioning, as they fulfill the minimum of their functions. In terms of regional comparison and localization, almost (43 %) of them are located in the Bratislava region. This is understandable, as they are a tool for bringing institutions and companies together in the field of science and research, while also reflecting the innovation performance of the regions. Despite the many benefits that they bring, they do not perform most of the functions in the regions and currently focus more on own R&D activities within the universities that set them up. Above all, however, these functions have no added value, because universities carry out their own research as standard, even without the occupancy of parks. USPs and RCs should provide a wide range of services to support the emergence of new ideas that can later be put into practice.

Finally, there is an assumption that the strategies of parks are heterogeneous and operation in the region differs (McCarthy et al., 2018). Lack or absence of plans, limited financial resources and lack of infrastructure are very important negative factors that affect the outputs and further direction of USPs and RCs development. However, strong cooperation, clustering and networking between companies, government, municipalities and other institutions are important factors influencing success. It seems that solutions with long-term sustainability of parks and centres will have to be clarified in relation to increase and reinforce Slovak investment to research infrastructures and keep them viable. We would like to expand our research accompanied by direct interviews with stakeholders so that we can better identify problem areas and management.

## **Acknowledgements**

This contribution was supported by the Scientific Grant Agency VEGA under the contract No.1/0605/19 „New role of universities in regional innovation systems”.

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