

Clusters as platforms for business-research (B2R)/research-business (R2B) relations

Country Report – Czech Republic

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List of Abbreviations

| | |
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| API | Agency for Entrepreneurship and Innovation (Agentura pro podporu podnikání a inovací) |
| B2R/R2B | Business-Research/Research-Business |
| CO | Cluster organisation |
| EU | European Union |
| GDP | Gross Domestic Product |
| MIT | Ministry of Industry and Trade |
| NCA | National Cluster Association |
| OECD | Organization for Economic Co-operation and Development |
| OPEI | Operational Programme Industry and Enterprise |
| OPEIC | Operational Programme Enterprise & Innovation for Competitiveness |
| R&D | Research & Development |
| R&D&I | Research & Development & Innovation |
| RIS | Regional Innovation Strategies |
| ROP | Regional Operational Programmes |
| RO/UNIV | Research organisations/Universities |
| SME | Small and Medium Enterprise |
| V4 | Visegrad countries: Czech Republic, Hungary, Poland, Slovakia |

Summary

Clusters represent one of the basic platforms for cooperation between companies and research institutions. Therefore, they can help to increase the competitiveness of regions in the Visegrad Four countries. Within the framework of the project "Clusters as platforms for business-research (B2R)/research-business (R2B) relations cofinanced by the Governments of Czechia, Hungary, Poland, and Slovakia" supported by the International Visegrad Fund (Visegrad Fund project No. 22030333), this report focuses on presenting the following issues of cooperation between firms and research institutions (B2R/R2B) in the territory of the Czech Republic (hereinafter referred to as Czechia). Therefore, the report presents specific answers to the questions of motives for cooperation, determinants shaping cooperation, identification of forms of cooperation, and presentation of selected best practices.

The clusters included in this research are characterised by several specific features to provide relevant information based on the proven quality of the cluster organisation's activities while at the same time having at least three research institutions as members and experience with research, development, and innovation activities.

Clusters in the Czech Republic: An Overview

Cluster organizations have been present on the territory of the Czech Republic for twenty years and have become a natural platform for cooperation between various entities in the relevant sector of the national economy. The emergence of clusters in the Czech Republic is closely linked to the targeted public support of the Ministry of Industry and Trade, which has supported the development of clusters from EU Structural Funds throughout their existence. These were and are intended to support regional and sectoral cooperation of actors and stakeholders on the territory through knowledge sharing, cost reduction, and increasing the innovative capacity of small and medium-sized enterprises to reduce regional disparities and increase national competitiveness. The instruments supported for this cooperation can be summarized as follows: A) collective research; B) shared infrastructure; C) internationalisation; D) cluster development. This public support has also resulted in the intensification of B2R/R2B cooperation. However, this faces specific problems in the transition countries of Central Europe, where a lower level of cooperation between these two actors of the innovation ecosystem is present in the territory compared to the countries of Western Europe.

R&D activities in clusters

R&D activities make up a varying proportion of activities in Czech clusters, reflecting both their preferred activities and the needs of their members, but especially of firms. It can be argued that to some extent there is a consistency between the share of R&D activities in the past three years and in the future three years. This shows that a given share of these activities is perceived by cluster managers as a stable part of their activities, with these and firm managers being the

decisive initiators of these activities vis-à-vis research institutions. This suggests that firms are aware of the importance and potential of research institutions in clusters to increase their competitiveness. Moreover, the results of these collaborations do not always serve only the partial objectives of a particular firm, but also the other members of the cluster.

Motives for B2R/R2B cooperation in clusters

The decisive motive for this type of cooperation in Czech clusters is primarily the savings of R&D costs through access to public research funding. This is followed by the sharing and transfer of state-of-the-art knowledge and cutting-edge technologies. Both motives are fundamental prerequisites for the development of a knowledge economy and provide a competitive advantage if managed appropriately. In contrast, researchers consider the most important motive for this collaboration to be the opportunity to expand their networking, especially in terms of attracting research projects and thus funding further research, including directly generating additional income.

Forms of B2R/R2B collaboration in clusters

The forms of cooperation between firms and research institutions show the decisive influence of clusters to stimulate this cooperation. On the other hand, a higher share of long-term cooperation is missing. An important assumption is that, although the COVID-19 pandemic has reduced contacts between cluster members, B2R/R2B collaboration is still taking place on a variety of platforms, ranging from information and knowledge exchange and student internships to the use of research institution premises by firms.

B2R/R2B cooperation activities in clusters

In addition to conducting research, a crucial activity in this type of collaboration is consulting, that is, knowledge transfer, exchange, and sharing. Furthermore, activities aimed at gaining funding for research activities and activities aimed at gaining qualified human resources, i.e., supervision of thesis and dissertation work, are reported.

Factors conditioning B2R/R2B cooperation in clusters

As with any human asset, there are factors that enable and limit collaboration. Those factors that facilitate collaboration can be divided into 1) financial - profit, cost reduction, 2) human resources and relationships - critical mass of participants for communication, trust, communication, and 3) facilities related to the sectoral similarity of activities between business and research organizations - common interest in a given area of research, and reputation enhancement.

Challenges and barriers to B2R / R2B cooperation in clusters

In contrast to universities in the USA and Canada, research in the field of engineering and natural sciences in the Czech Republic is concentrated exclusively in the environment of public universities. This suggests a different approach to perceptions of time, workload, interests and needs, and management practices between firms and research institutions. It is the complex organisational structure, including the organisational culture, that is perceived as a persistent problem and a challenge for the future for firms and research institutions. This implies that it is necessary to invest not only in R&D projects alone, but to find a modus vivendi to optimize the decision-making structures of public universities while respecting their decision-making autonomy, and at the same time to improve communication between the two parties leading to mutual understanding. Here is the key role of the cluster manager as a mediator of these negotiations and communication.

Financial resources for B2R/R2B cooperation in clusters

Although the financial resources for R&D support between companies and research institutions are to a significant extent made up of company resources, it is natural and desirable that most of them should be made up of external resources to show their quality in competition with other projects. Moreover, the aim of this cooperation is precisely to reduce the cost of R&D activities for companies and thus innovation. The low share of international projects as sources of funding for R&D activities between companies and research institutions in clusters, which shows a limited level of excellence, is a major problem compared to Western European countries.

Conclusion

B2R/R2B cooperation requires targeted, intelligent, and deliberate support, based primarily on better mutual knowledge and understanding of both parties, with the common goal of a higher degree of internationalisation to achieve excellence and greater competitiveness against OECD countries and China.

Introduction

This national report was written under the project 'Cluster platforms for business research (B2R) / research-business (R2B) relationships' financed by Czechia, Hungary, Poland and Slovakia through Visegrad grants from the International Visegrad Fund (Visegrad Fund project No. 22030333).

The research goal of the project is to identify collaboration models between business and research facilitated by cluster organizations, based on the mapping of best practice across V4 countries. According to the theoretical cluster model, such collaboration should emerge in every cluster as one of the cornerstones of its existence. The project also aims to demonstrate why both companies and research organizations benefit from working together.

The project focuses on cluster organizations and avenues for collaborative efforts between business and research within territorial ecosystems in Czechia, Hungary, Poland, and Slovakia, according to the quadruple helix model. Additional goals of the project are as follows.

- ! examine the motives for B2R/R2B partnerships between business and research institutions in cluster organizations,
- ! to identify factors that shape B2R/R2B in cluster organizations,
- ! to identify forms of B2R/R2B in cluster organizations,
- ! to define the best practices of B2R/R2B in cluster organizations that can be transplanted and implemented in other V4 countries.

According to the project methodology, the research presented in this national report was carried out in three steps:

1. Conducting in-depth interviews with cluster organizations to define the role of the research organizations in the cluster organizations.
2. Conducting a survey among research organizations to collect data on the different forms of collaboration and their main benefits.
3. Conducting interviews with the representatives of research organizations to expand on the data collected in the survey.

The purpose of the in-depth interviews was to gather qualitative information on the role of research organizations in cluster organizations, to assess the added value of collaboration, and to identify forms of collaboration that work well. The interviews provided information on (i) the lessons learned so far and (ii) the expectations and needs for policy instruments that can improve B2R/R2B partnerships. This part of the study helped identify the main motivations for partnering, the results of the collaboration, and the factors that can determine its forms and scope. The interviews helped identify the most important challenges and barriers to consider when designing prospective support instruments. The subsequent steps of the study were

based on interviews with managers of the cluster organizations. The purpose of the survey among research organizations was to collect up-to-date and comparable data on the forms of collaboration with enterprises, as well as the resulting benefits for research organizations and universities. To further explore collaboration from the perspective of the science sector, semi-structured interviews were carried out with employees of research organizations that deal directly with companies belonging to cluster organizations.

The present national report elaborates on the data collected during the study. The whole project encompasses four national reports: for Czechia, Hungary, Poland, and Slovakia. The purpose of the reports was to analyze the role of cluster organizations in facilitating partnerships between enterprises and research organizations. National reports present key findings about such partnerships and good practice that can be disseminated.

The national report is structured as follows. The first chapter provides an analysis of the current state of collaboration between business and research institutions. The second chapter gives an overview of the cluster landscape in the country, as well as the national cluster policy in recent years. It also includes a profile of the cluster organizations that participated in the study. The third chapter provides information on the motivations for pursuing B2R/R2B in cluster organizations and the related benefits for stakeholders, including factors that have motivated researchers to pursue collaboration with a cluster organization and its members. The fourth chapter gives an overview of the forms of B2R/R2B functioning in practice among cluster organizations. The fifth chapter discusses the factors shaping (and, in particular, promoting) B2R/R2B collaboration in cluster organizations. The challenges, barriers, and detrimental factors are analysed in the following chapter to answer the question of what can hinder B2R/R2B. In the opinion of the respondents, the cost of collaboration caused by administrative overhead is the most significant barrier. The seventh chapter presents good practices of collaboration in cluster organizations that can be transplanted and implemented in other V4 countries. Finally, the last chapter provides recommendations and conclusions, focusing on suggested measures to improve cluster policy and support cluster organizations.

The authors of the report would like to express their sincere gratitude to all the respondents who kindly agreed to participate in the study and to share their knowledge, opinions, and thoughts.

Current status of cooperation between business and research institutions

Growing innovation-based businesses are key to a sustainable model of economic growth. According to the European Innovation Scoreboard 2019 is 84.3, that is, below the EU average. In the Czech Republic most economically developed countries are still hampered by the low innovation performance of domestic businesses, especially small businesses, whose innovation performance stagnated or weakened between 2010 and 2017, showing inadequate internal research and innovation activities by international comparison. Despite the fact that total expenditure on research and development has been growing for a long time in the Czech Republic, the Czech Republic still reports slightly below average gross domestic expenditure on research and development in the EU context, namely 1.94% of GDP in 2019. In the Czech Republic, large businesses tend to dedicate a higher share of their revenues to research and innovation than SMEs. In general, around 70% of the private sector R&D expenditure comes from large businesses, which means that SMEs account for less than a third of private R&D investments and, in addition, most of the R&D expenditure of SMEs is implemented in the medium and low-tech sectors. Moreover, most of this expenditure in Czech firms goes to experimental development. In addition to the need to intensify support for domestic innovation, including creative innovation, which could increase productivity across the entire corporate spectrum, there will also be a need to focus on improving research performance and improving cooperation between the private sector and academia. Collaborative relationships between innovative enterprises have generally gained momentum in years of economic growth, which confirmed the improvement in collaboration between supported enterprises and HEIs and universities. However, the Czech Republic still has a gap in the intensity of links between academia and the application or business sphere to support improved knowledge and technology transfer compared to many developed countries. The 'SME Support Strategy in the Czech Republic for the period 2021-2027, prepared by the Ministry of Industry and Trade (MIT) and approved by the government, aims to increase the productivity and competitiveness of Czech SMEs and thus, at the same time, strengthen the international position of the Czech Republic, especially in the field of research and innovation or the use of advanced technologies and skills. The concept of the strategy is based primarily on the findings and recommendations of the World Bank. The key areas addressed in the document include the business environment, access to finance, access to markets, the workforce, skills and education, research, development and innovation, digitalization, low carbon economy, and resource efficiency.

SMEs play an irreplaceable role in terms of growth of the Czech economy, job creation, or innovation. However, their development may be hindered by a number of factors, such as limited access to finance, information on new technologies and potential markets, insufficient

innovation capacity, or the business environment itself. To facilitate the development of SMEs, the government wants to conceptually support this segment, thus ensuring the growth of their productivity and competitiveness. Creating a functioning innovation system is an essential prerequisite to improve the innovation performance of firms. Therefore, support will focus on systematic cooperation in innovation and on a deeper participation of SMEs in cooperation networks (including the research and public sectors). The main objective of the measures implemented is to improve the quality of the Czech innovation ecosystem for Czech SMEs and to ensure the most favorable conditions for the development of their innovation activities. Therefore, the measures will aim directly at creating and developing an ' i n n o v a t i o n e c o s y s t e m ' that is, in favor of the interconnectedness of individual activities or solitary institutions, with a characteristic emphasis on linking academic and business environments to support knowledge and technology transfer, for example, in terms of strengthening the functioning of technology transfer centers at universities, or strengthening the incentive system for universities to motivate them to start up spin-offs and carry out contract research. Deeper cooperation between operators of business incubators, innovation centres, and accelerators and leading technology companies and cluster organisations in providing special services to start-ups and scale-ups will allow them to better navigate issues relating to advanced technologies.¹

It can be argued that even clusters were not a priority in terms of public policies, but their importance was perceived mainly in R&D and emerging industries. Cluster organizations could become an important element of an ecosystem to help in strengthening R&D&I activities and create a platform for linking the academic and business environments to support knowledge and technology transfer. Cluster organisations support cooperation of their members with innovation structures such as innovation centers, technology transfer centers, regional innovation forums, etc. (70% of the COs in the survey confirmed such cooperation), and the numbers of research institutions (universities or other research organisations) are even members of the COs (32 universities and 13 research organizations in 10 COs).

¹ <https://www.mpo.cz/assets/en/business/small-and-medium-sized-enterprises/studies-and-strategic-documents/2021/9/Strategy-to-support-SMEs-in-the-Czech-Republic-2021-2027.pdf>

Collaboration B2R / R2B has been attributed on the basis of a combination of pressures on both sides (Giuliani & Arza, 2009; Meyer-Krahmer & Schmoch, 1998). Firms face rapid technology development, shorter product life cycles, and intense global competition that have radically transformed the current competitive environment for most of them (Bettis & Hitt, 1995; Wright et al., 2008). With regard to RO/UNIV, pressures have included the growth in new knowledge and the challenge of rising costs and funding problems (Hagen, 2002). Furthermore, there is increasing societal pressure on universities to be seen as engines of economic growth. These pressures on both parties have led to an increasing stimulus for developing this collaboration that aims to enhance innovation and economic competitiveness (Ankrah & AL-Tabbaa, 2015). Moreover, B2R/R2B has been widely perceived as a promising tool for enhancing organizational capacity in open innovation, where an organization employs external networks in developing innovation and knowledge (Dess & Shaw, 2001), as a complementary option to traditional internal R&D (Harvey & Tether, 2003). The cluster organisation could become an effective platform for this relationship building and could play an important role in initiating R&D&I cooperation between firms and RO/UNIV (as seen in Figures 1 and 2). All surveyed clusters included the cooperation strategy with RO/UNIV in the strategic development plans of their CO.

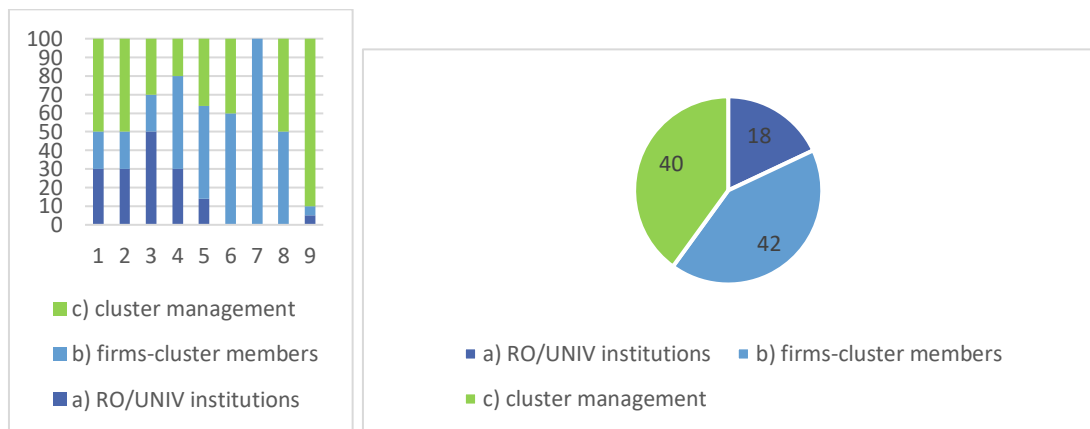


Figure 1 Initiating R&D&I cooperation between firms and RO/UNIV within clusters

Source: own elaboration based on interviews with cluster managers

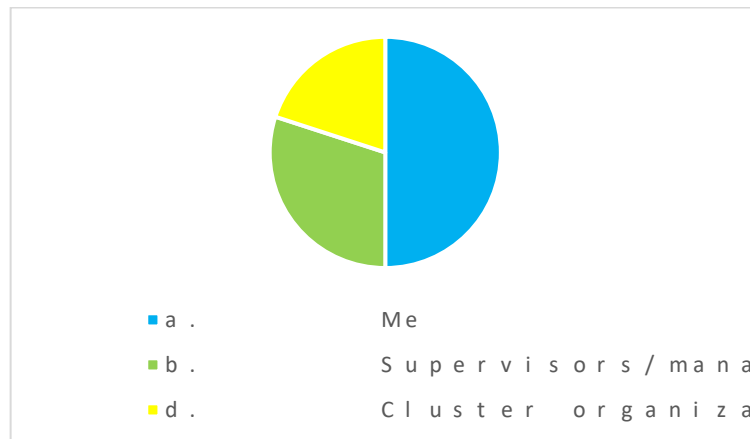


Figure 2 Initiating R&D&I cooperation between researchers and the CO / CO member firms

Source: own elaboration based on interviews with researchers

The firms of the COs and RO/UNIV join together in common small and also complex domestic or international R&D&I projects (see the evidence of the COs studied and the interviewed researchers in Figures 3 and 4) to develop new or improved products, new technologies to develop the assembly line, digitalization of processes, AI applications, innovation, logistics, design innovation, etc. All surveyed clusters declare results in companies and also in business process innovations. The solution of complex R&D&I projects is achieved mainly in results in the form of industrial designs, utility models, proven technologies, prototypes, and also patents (mainly a small number of patents or licenses).

Most of the members, strategic innovators, participate in B2R/R2B cooperation and common research projects, but the results of projects are usually available for all cluster members under defined conditions in advance.

The COs apply for project support mainly within the schemes of OP Cooperation, RIS3 strategies, educational projects for human resources development, project support provided by the Technology Agency of the Czech Republic, Ministry of Industry and Trade, Ministry of Agriculture, Ministry of Transport, Horizon, & COSME.

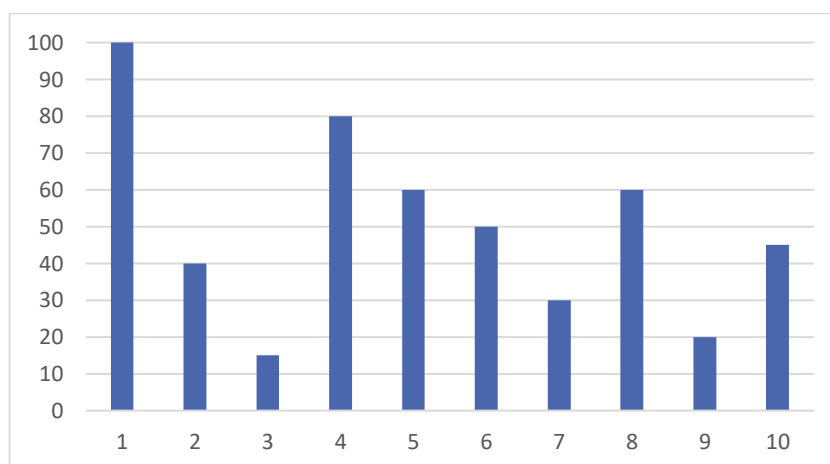


Figure 3 Share of firms - cluster members actively included in R&D&I cooperation between firms and RO/UNIV (%)

Source: own elaboration based on interviews with cluster managers

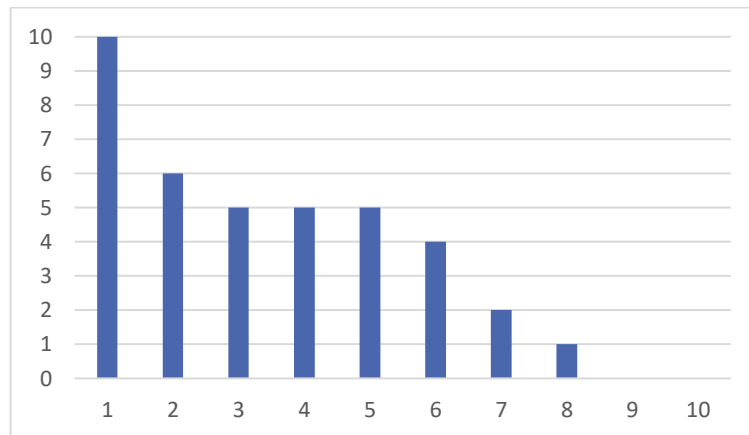


Figure 4 Numbers of international R&D&I projects (such as Horizon 2020) with a cluster as a partner

Source: own elaboration based on interviews with cluster managers

Overview of the cluster development in recent years

The cluster concept came to the Czech Republic with the need to address pressing problems related to the transition economy of the country's transition economy, unemployment, low competitiveness, sporadic innovation and lack of business cooperation culture. "National Cluster Strategy 2005-2010, announced by the Czech government, placed an emphasis on the use of clusters to interconnect resources and programmes measures under various strategies and policies. Simultaneously the attention of the Operational Programme Industry and Enterprise (OPEI) for the years 2004-2006 has been focused on the issue of clusters within the so-called CLUSTERS Programme with support explicitly focused on clusters and cluster initiatives. Although support for clusters had been continued within the OP Enterprise and Innovation 2007-2013, no further steps have been undertaken towards a conceptual strategy for cluster policy development in the Czech Republic. Establishment and development of clusters were made a priority under National Innovation Policy 2005-2010 with expected results - growing number of established cluster organisations (COs) and innovation firms at a regional level. The OPEI Programme and its COOPERATION Programme, within the Priority "Enterprise and Innovation", "Environment and Regional Development", focused on creation of favourable entrepreneurial environment and support of the formation and development of cooperation groups, i.e. cluster organisations and technology platforms. It concentrated on strengthening the innovative potential and the use of new technologies as well as aiming at stimulating cooperation between enterprises and research institutions². The Programme also promoted internationalisation through the CORNET project of the FP7. Additional operational programmes have also been implemented within the time frame 2007-2013 playing an important role in cluster development in the Czech Republic though indirectly influencing their growth: the OP Human Resources and Employment focused on strengthening active labour market policies, the OP Research and Development "Development of Innovation" focusing on commercialisation and popularisation of R&D, and the OP Education for Competitiveness where special attention has been paid to the preparation of human resources for the formation and functioning i.e. of technologically focused clusters. In September 2011 the Government adopted a new set of priorities, with National Innovation Strategy for the programme period 2012-2020. The strategy emphasises a co-operation and networking between companies in order to improve their competitive advantage based on innovation through clusters.

² Operational Programme Enterprise and Innovation [online]. Ministry of Industry and Trade of the Czech Republic [quot. 28 February 2011]. Available on WWW: <<http://www.czechinvest.org/data/files/oppi-msc-en-29-11-schvalen-ek-674.pdf>>.

In December 2013 the Ministry of Industry and Trade certified two methodologies for development of cluster policies³ and National Cluster Policy⁴ prepared by Pavelková et al. from Tomas Bata University in

Operation Programme Enterprise & Innovation for Competitiveness (OPEIC) 2014-2020, with the programme COOPERATION-CLUSTERS promoted business investment in innovation and research, to improve the quality of R&D infrastructure and create links between enterprises and R&D institutions. The programme was focused on promoting the development of innovation networks, clusters as tools for increasing the intensity of joint research, development and innovation activities between business and research sector. It supported collaborative research, open centres for R&D&I, cluster internalisation and cluster organisation management.

Apart from programmes undertaken on a national level, the policy is being pursued on a regional level within the Regional Operational Programmes (ROP) and Regional Innovation Strategies (RIS). Through covering several thematic areas with the aim of accelerating development and increasing regional attractiveness for investors as well as facilitating innovation and infrastructure development, promoting entrepreneurship and creating favorable supportive conditions for enterprises, they indirectly support cluster development. Differences in the importance and intensity of the steps undertaken with regard to clusters are visible within the regions. Several of them appear as active, while others treat the cluster issues marginally.

The Ministry of Industry and Trade (MIT) and their subordinate CzechInvest can be distinguished among the actors historically responsible for the coordination of activities and programmes focused on clusters in the Czech Republic. The MIT is responsible for the conceptual issue of the cluster phenomenon and cluster policy implementation in the country, whereas CzechInvest is in charge of its practical application. CzechInvest focused its activities on strengthening the competitiveness of the Czech economy through supporting SMEs, business infrastructure, innovations and attracting foreign investments in the areas of manufacturing, business services and technology centres. It was widely involved in cluster issues, both in the application of a policy based on clusters as well as being the intermediate body assisting in providing support for cluster organizations. From 2016 Agency for Entrepreneurship and Innovation (Agentura pro podpora inovací - API) has taken responsibility of CzechInvest regarding the support of OPEIC for cluster development.

The National Cluster Association (NCA) was consequently founded as a long-term and competent platform for cluster development in the country. It has been actively involved in

³ Pavelková, D. et al. *National Cluster Policy (Certificate methodology)*. Zlín: Tomas Bata University, 2013. ISBN 978-80-7454-326-5.

⁴ Pavelková, D. et al. *Regional Cluster Policy (Certificate methodology)*. Zlín: Tomas Bata University, 2013. ISBN 978-80-7454-327-2

cluster issues since 2010. The association focuses on representing the interests of Czech cluster initiatives, facilitating their development, and stimulating their internationalisation (representing them on an international arena). It provides information support, training of instructors/facilitators, promotes clustering and is directly (actively) involved in the establishment of clusters. NCA does not associate only clusters, but also universities, regional and innovation agencies, and consultants.

Clusters in the Czech Republic are characterized by the period of almost two decades of existence; the oldest Czech Machinery Cluster emerged in 2003. Rapid development of clusters has been observed since 2006 in relation to announcement of the subsidy programme OPIE Clusters. At the beginning of 2022, NCA maps 57 active cluster organisations in the Czech Republic⁵. A variety of industry sectors, both in traditional as well as in high-tech branches, can be observed, with a predominance of manufacturing industries. The largest number of clusters exist in the Moravian-Silesian and South Moravian regions, while, in contrast, there are regions such as st nad Labem or Plze with poor interest in clusters/cluster initiatives development.

In the Czech Republic, no systematic tool for cluster performance e v a l u a t i o n has' e v a l u been accepted. Methodology certified by MIT in 2013 includes the proposal for the accreditation system, but only the philosophy of this system was applied for the evaluation of cluster organisations when they applied for financial support within the Operational Programme Enterprise & Innovation for Competitiveness 2014-2020 (OPEIC), COOPERATION-CLUSTERS. This evaluation scheme prepared by the research team of Drahomira Pavelkova from Tomas Bata University in Zlin in 2015 categorizes the cluster organisations into three groups according to performance: i) excellent COs, ii) developed COs, and iii) immature COs. On the basis of this categorization, COs can apply for projects with different aims and amount of financial support for e.g. collaborative research, shared infracture, internationalization activities, or just management of COs.

The aim of the last call in 2020 was to support the development of innovation networks - clusters - as a tool for increasing the intensity of joint research, development, and innovation activities between business entities and the research sphere. Strengthening mutual links at the regional, supraregional, and international levels will lead to the development of a knowledge- and innovation-based economy and the implementation of the concept of smart specialization. The supported activities were:

- (a) Collective research projects should meet the conditions set out in the definition of collective and pre-competitive research. For each project proposal, the applicant should provide evidence of at least 3 potential users of the project results (SMEs). Projects should be carried out in cooperation with research institutions in the form of

⁵ www.nca.cz

contract research contracts. Collective research projects within the international Cornet network were also supported.

Collective research - research and development activities that respond to the innovation needs, in particular of SMEs in a given industrial sector or specific technological area within the cluster. The results of the project are always usable by several enterprises, which can develop their own specific solutions for new products, processes, and services on the basis of the results. Collective research projects must meet the following conditions:

- they are joint cluster projects in line with the sectoral focus or technological area of the member enterprises,
- the projects are precompetitive in nature,
- the results are mainly usable by SMEs and represent for the economic benefits,
- the cluster will make the results available to all interested parties under normal nondiscriminatory conditions. No exclusive use of the results for one or more entities is allowed.

b) Shared infrastructure: setting up/developing and equipping an open access cluster centre for industrial R&D&I purposes.

c) Cluster internationalisation - establishing cooperation in the European Research Area, joining cross-border networks of excellent clusters (with emphasis on future challenges and key technologies), coordinated access to third markets, etc.

d) Development of the cluster organisation - activities leading to the expansion of the cluster and improvement of its quality.

The aim of the Operational Programme Technologies and Applications for Competitiveness for the period 2021-2027 approved by the Czech government is to increase the added value and productivity of SMEs in particular, as well as to develop new innovative companies and facilitate the transition to a sustainable and digital economy. The programme focuses on strengthening the performance of businesses in R&D&I and their digital transformation, developing entrepreneurship and competitiveness of SMEs, developing digital infrastructure and moving toward a low-carbon economy and more efficient use of resources.

The Economic Strategy of the Czech Republic 2020-2030 was supposed to be created, there is a document called "Theses of the Economic Strategy of the Czech Republic 2020-2030", which contains strengths and weaknesses compiled according to the World Economic Forum's Global Competitiveness Index. The state of development of clusters is listed here among the weaknesses of the country.

The document 'Innovation Strategy of the Czech Republic 2019-2030' mentions 'clusters' terms of the number and quality of its research centers and research infrastructures of the Czech Republic. This strategy supports achievements in the integration of Czech firms into industry clusters with the participation of research institutions and identifies tools how to achieve it, eg, connection of „N&I and OP RDCCenters with industry

clusters, or participation of European 2020+ Operational Programmes for building research clusters.

The development of the cluster concept is not mentioned in the “Regional Development Strategy of the Czech Republic 2021-2027”; however, the promotion of the establishment of clusters in regions taking into account the potential of the territory was highly recommended in the certificate methodology “Regional Cluster Policy”.

The research within the project focused on the analysis of the environment for the development of cluster organizations as a platform to support B2R/R2B cooperation. According to the project methodology, the research presented in this national report was carried out in three steps:

1. Conducting in-depth interviews with cluster organizations to define the role of the research organizations in the cluster organizations.
2. Conducting a survey among research organizations to collect data on the different forms of collaboration and their main benefits.
3. Conducting interviews with the representatives of research organizations to expand on the data collected in the survey.

Cluster managers of 10 selected clusters from the different sectors acting in the Czech Republic have been involved in the survey using semi-structured interviews. Selection was made according to the following criteria: i) at min. 3 RO/UNIV as members of CO, ii) excellent CO according to eligibility criteria close to the “accreditation scheme of NCA.” The objective of the interviews with the cluster managers was to obtain information on the forms, motives, activities, and barriers to B2R and R2B cooperation on the platform of the cluster organizations. Also, to obtain feedback on the cluster policy and support how it is effective and helpful or whether it misses some of the important components and how it can be improved by identifying helpful policy instruments focusing on development of R2B/B2R cooperation. Best practices were also collected as inspiration for the future development of this cooperation.

The purpose of the survey among research organizations and researchers was to gather up-to-date and comparable data on the forms of collaboration with firms, as well as the resulting benefits for research organizations and universities on the CO platform. Individual researchers, identified on the basis of common cooperation by cluster managers of COs involved in the previous survey, were contacted and questioned on the basis of the prepared questionnaire.

The characteristics of the cluster organisations involved in the survey, indicating the sectoral focus of the COs, year of establishment of the COs, number of members with the number of SMEs and RO/UNIV excluded, and also information about CO staff are provided in Table 1.

Table 1 The characteristics of clusters participated in the study

| Cluster | Legal form | Predominant field(s) of cluster activity (NACE) | Year of cluster foundation | Number of cluster members | Out of which: | | Cluster management (persons/ full-time contracts) |
|---------------------------|------------------------|---|----------------------------|---------------------------|---------------|---------|---|
| | | | | | SMEs | RO/UNIV | |
| Czech Optic Cluster | registered association | 26.70.1 | 2017 | 28 | 13 | 11 | 6/1 |
| Plastic Cluster | registered association | 22.2 | 2006 | 51 | 47 | 2 | 6/6 |
| Furniture Cluster | registered association | 31.00 | 2006 | 48 | 34 | 4 | 19/13 |
| Czech Implant Cluster | registered association | 32.50 | 2017 | 27 | 17 | 6 | 3/1 |
| CREA Hydro&Energy Cluster | registered association | 28.99; 63.11; 72.19 | 2014 | 22 | 17 | 3 | 19/2 |
| Clutex cluster | registered association | 13.00; 13.96 | 2006 | 35 | 31 | 4 | 4/1 |
| Autoklastr | registered association | 29.00; 33.10; 72.10 | 2006 | 90 | 55 | 5 | 9/5 |
| IT Cluster | registered association | 61.00; 62.00 | 2006 | 30 | 11 | 3 | 2/0 |
| AERO Cluster | registered association | 30.30 | 2010 | 71 | 42 | 3 | 5/3 |
| Nanoprogress | registered association | 13.99 | 2010 | 61 | 48 | 4 | 20/11 |

Source: own elaboration

Figure 5 shows the excellence of these COs – all COs surveyed received at min. bronze label awarded by ESCA. Figure 6 indicates the technological development of the members of the CO companies using the share of firms in COs that are included among i) strategic innovators (research and development carried out continuously) and ii) technology recipients (they do not have their own research).

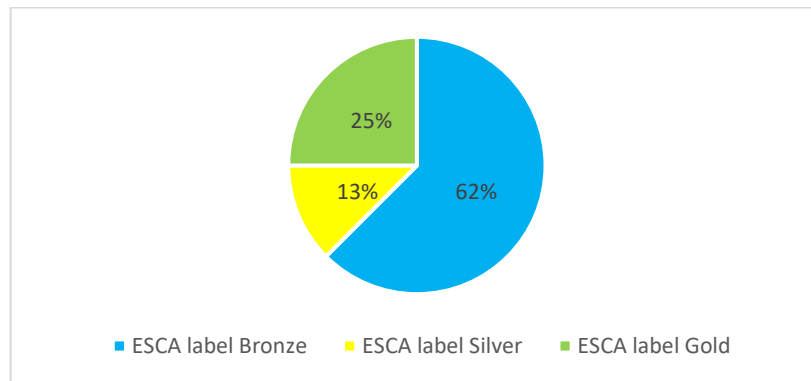


Figure 5 Cluster Excellence Labeling

Source: own elaboration based on interviews with cluster managers

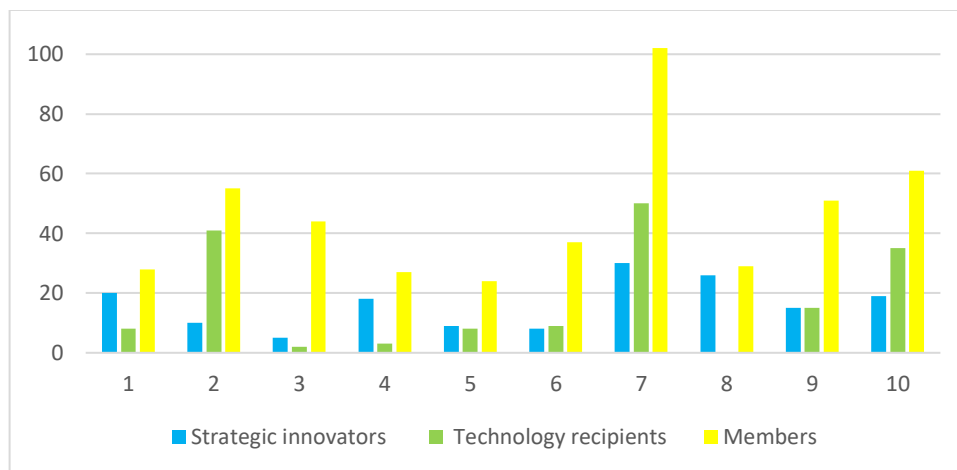


Figure 6 Technological advancement of the cluster members

Source: own elaboration based on interviews with cluster managers

The number of members in organisations in the Czech Republic and in the sample of clusters is in the order of tens, none of the clusters exceeds 100 members. The dynamics of CO development in the last three years was different, but all surveyed groups indicate a positive change in the number of CO members despite the pandemic situation from spring 2020.

All COs, except two, are led by full-time cluster managers. The number of employees and FT employees differ in particular COs, but according to the opinions of the cluster managers, all COs have people with skills in project management and administration, and also all, except one CO, in the management of international activities and, except for two COs, in the management of R&D&I.

Recently, COs have focused mainly on supporting the development of common R&D&I and international activities, and all COs have developed to some extent the activities that support

networking and human resource development. COs devote rather marginal attention to marketing and the necessary time also to administration (Figure 7). Figure 8 shows a very similar trend in the focus of COs activities for the next three years.

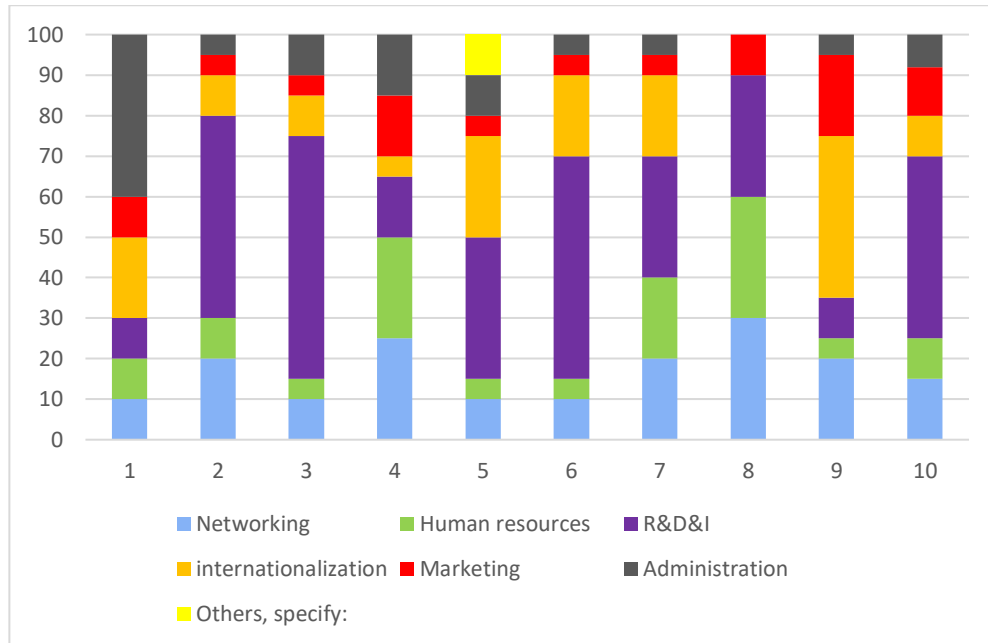


Figure 7 Activities of cluster organisation in the last 3 years (100 points divided)

Source: own elaboration based on interviews with cluster managers

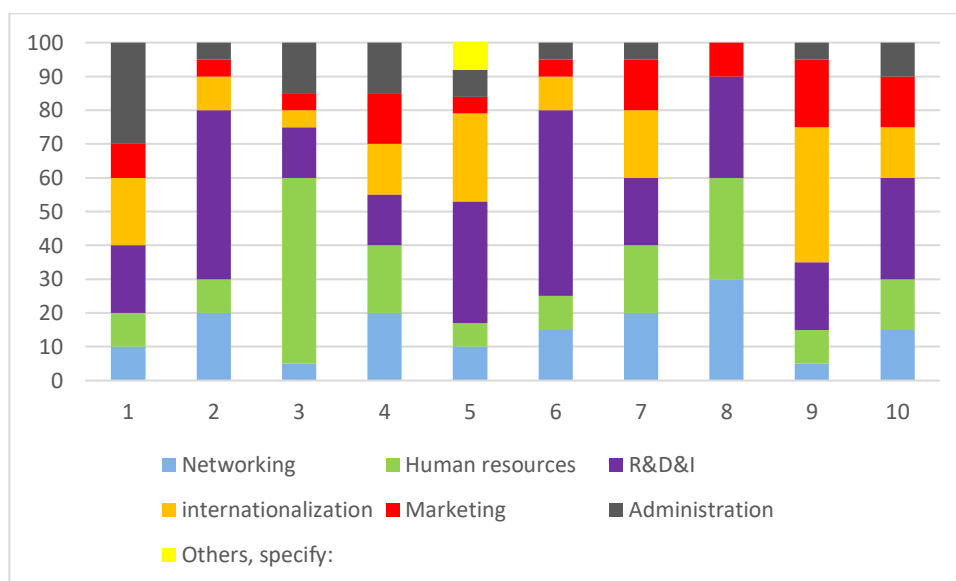


Figure 7 Activities of cluster organisation in the next 3 years (100 points divided)

Source: own elaboration based on interviews with cluster managers

The situation of the Covid-19 pandemic in the last two years affected the development of clusters, according to information obtained from interviews with cluster managers, especially in the following areas: limited networking activities; most communication took place through on-line platforms, the dynamics in newcomers has been affected; cooperation on internal projects and the focus on new projects has been intensified. From the point of the view of researchers, influence on the intensity of their cooperation with the cluster organization and its members is not unambiguous (Figure 9).

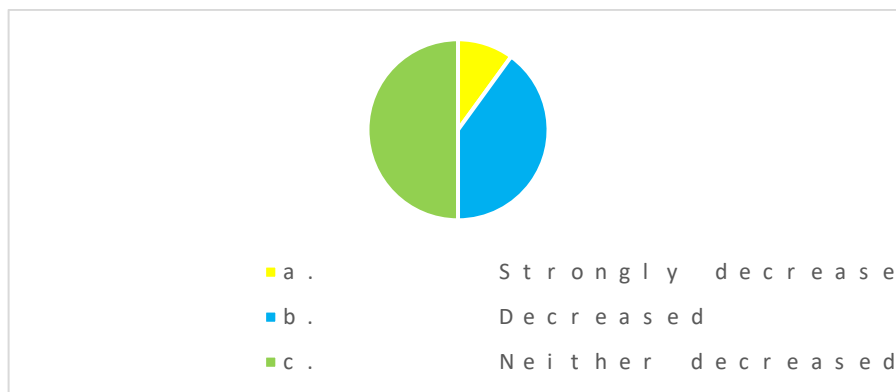


Figure 9 Influence of the COVID-19 pandemic on the intensity of research cooperation with the cluster organization and its members

Source: own elaboration based on interviews with researchers

Motives for B2R/R2B cooperation in cluster organizations and benefits for the stakeholders

The number of collaborations between industry and universities has increased dramatically in the last two decades (Mirc et al., 2017), and this trend appears to be accelerating (Scandura, 2016, Villanii et al., 2017). One of the crucial reasons behind this is the joint capacity of B2R/R2B to promote the process of technology transfer (Perkmann et al., 2013) and the lack of internal capacity of industry to carry out technological research. The most important motive for cooperation between companies and RO / UNIV includes access to research funding, to which all cluster managers agree. This is confirmed by study (Barnes et al., 2002), that governments stimulation of R&D and the growth of technology through the use of financial instruments like grants and tax credits could be very important. Other important motivations for cooperation are the influence of research directions, the development of human capital, cost savings, access to research networks, and access to new knowledge. In general, it can be stated that the cluster manager considers all the motives mentioned in Table 2 and Figure 8 important.

Table 2 Motives for cooperation between firms and RO/UNIV

| Motives | Strongly | | | | Strongly |
|---|----------|-------|-----------|----------|----------|
| | Agree | Agree | Undecided | Disagree | Disagree |
| a) Access to research funding | 70 | 30 | 0 | 0 | 0 |
| b) Access to new knowledge, cutting-edge technology, state-of-the-art expertise/research facilities, and complementary know-how | 50 | 30 | 20 | 0 | 0 |
| c) Business opportunity, e.g., exploitation of research capabilities and results or deployment of IPR | 40 | 30 | 20 | 10 | 0 |
| d) Multidisciplinary character of products and technologies | 40 | 20 | 40 | 0 | 0 |
| e) Opportunity to access a wider international network of expertise | 40 | 20 | 40 | 0 | 0 |
| f) Access to research networks or pre-cursor to other collaborations | 20 | 60 | 20 | 0 | 0 |
| g) Influence research directions and new programs for industry | 30 | 60 | 10 | 0 | 0 |
| h) Limitation of inter-firm conflicts of interest | 20 | 30 | 50 | 0 | 0 |
| i) Risk reduction/sharing | 20 | 40 | 40 | 0 | 0 |
| j) Cost savings | 50 | 30 | 20 | 0 | 0 |
| k) Human capital development | 10 | 80 | 10 | 0 | 0 |

Source: own elaboration based on interviews with cluster managers

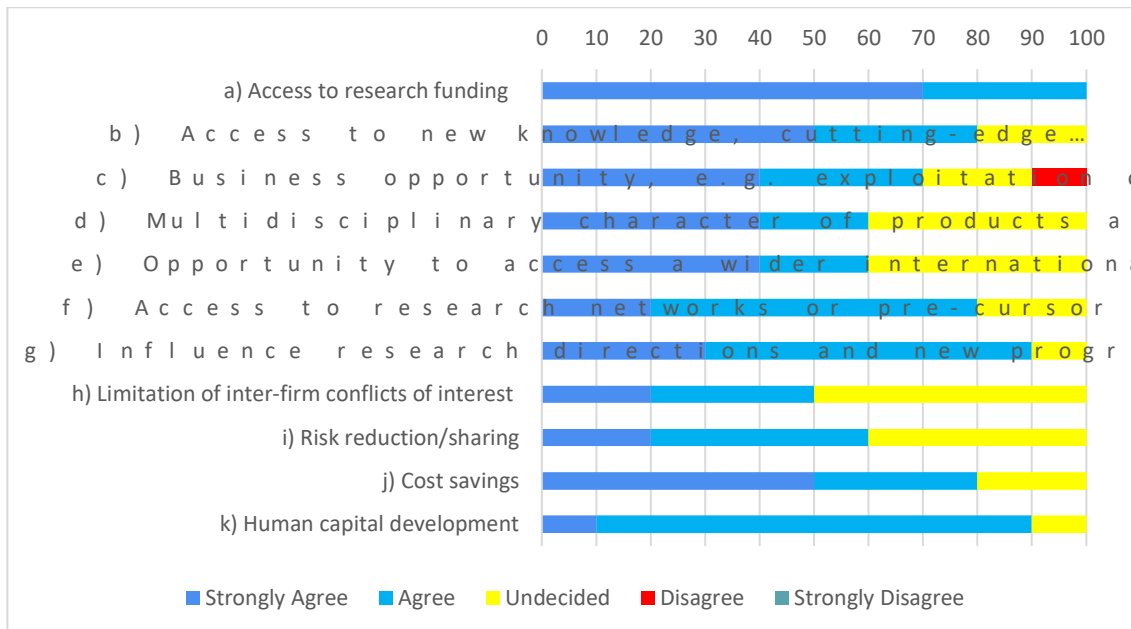


Figure 8 Motives for cooperation between firms and RO / Univ

Source: own elaboration based on interviews with cluster managers

All Czech cluster managers involved in the questionnaire confirmed product / service innovation as a result of mutual cooperation between firms and RO/UNIV, 80 % of them confirmed business process innovation. Most of the Czech cluster managers confirmed moderate or considerable impact on the technological progress of the firms cluster members. The most important benefit for the development and support of cooperation between firms and RO/UNIV belongs to matchmaking for R&D, access to funds, access to unique know-how and key technologies, human resources development, mutual projects, and communication.

Universities offer extensive access to a wide variety of research expertise and research infrastructure, while industry offers extensive access to a wide range of expertise in product development/commercialization, market knowledge (Sherwood et al., 2004) and employment opportunities for universities graduates (Lee & Win, 2004; Santoro & Betts, 2002). Therefore, universities and researchers can be motivated to build relationships with industry to take advantage of these strengths for mutual advantage. Our research confirmed that the most important factors motivating researchers to cooperate with the cluster organization and its members are the ability to expand networking and receive non-financial research assistance (see Table 3). Other important factors are receiving research funding, gaining access to infrastructure, and commercializing research findings. In contrast, the least important factor that motivates researchers to cooperate is personal financial benefit.

Table 3 Factors that motivate researchers to cooperate with the cluster organization and its members

| To what extent have the following factors motivated you to pursue cooperation with the cluster organization and its members (important) | Extremely | Very | Moderately | Slightly | Not at all |
|---|-----------|------|------------|----------|------------|
| a. Ability to extend my network (networking) | 70 | 20 | 10 | | |
| b. Receiving research funding | 30 | 30 | | 20 | 20 |
| c. Commercializing research findings | 10 | 10 | 40 | 10 | 30 |
| d. The necessity to undergo an employee evaluation at the university/research institution/other institution | | | 50 | 30 | 20 |
| e. Gaining access to infrastructure (e.g. lab equipment) | 30 | | 10 | 10 | 30 |
| f. Receiving nonfinancial research assistance (e.g., access to data, exchange of knowledge with practitioners, developing technology) | 50 | 50 | | | |
| g. Personal financial benefits | | | | 30 | 70 |

Source: own elaboration based on interviews with researchers

Forms of B2R/R2B cooperation in cluster organizations

The forms of B2R/R2B cooperation mostly pursued in practise and discussed in the literature are: Joint Ventures, Networks, Consortia, and Alliances (Barringer & Harrison, 2000), and these different forms vary by the degree to which the participants are linked. In the Czech environment, all forms of cooperation between firms and RO / UNIV which are mentioned in Table 4 are important. All cluster managers confirmed that the most common form of cooperation is cooperation in the form where RO / UNIV is a member of the cluster. Ring and van de Ven (1994) note that the issue of formalization is very important because of the argument that increasing formalization and monitoring of the relationship in B2R/R2B could lead to conflict and distrust among the parties in their attempt to maintain the autonomy of their organizations in face of increasing interdependence.

Table 4 Forms of cooperation between firms and RO/UNIV

| Forms of cooperation between firms and RO/UNIV | Percentage |
|--|-------------------|
| a) RO/UNIV as members of cluster | 100 |
| b) long-term agreement of RO/UNIV about cooperation with cluster/association contracts | 50 |
| c) technology platform | 50 |
| d) alliance (common initiatives for cooperation)/informal channel | 60 |
| e) occasional cooperation | 80 |
| f) endowed chairs and advisory boards | 70 |

Source: own elaboration based on the interviews with cluster managers

Cluster managers confirmed that the types of activities undertaken in cooperation between companies and RO/UNIV within the cluster are very different, all cluster managers use information exchange forum, participation in seminars, conferences, use of RO/UNIV/ industry facility (Table 5). Frequently used activities are also student internships, student involvement in firm projects, liaison offices, domestic/international cooperative R&D&I projects. A surprising result is that a relatively underused activity is staff mobility.

Table 5 Types of activities undertaken in cooperation between firms and RO/UNIV within the cluster

| Types of activities between firms and RO/UNIV | Percentage |
|---|-------------------|
| a) information exchange forum (eg. meetings of cluster members) | 100 |
| b) participation in seminars, conferences, exhibitions, fairs | 100 |
| c) use of RO/UNIV/industry facility | 100 |
| d) liaison offices (in RO/UNIV or industry) | 80 |
| e) domestic/international cooperative R&D&I projects | 70 |
| f) students' internships | 90 |
| g) students' involvement in firms' projects | 80 |
| h) staff mobility | 30 |

Source: own elaboration based on the interviews with cluster managers

Technology transfer is regarded as a major element between firms and RO/UNIV, which involves numerous activities such as networking, curriculum co-design and delivery, personnel mobility, training, and collaborative R&D. 70 % of Czech cluster managers confirmed that the most commonly used models of cooperation between firms and RO / UNIV are collaborative R&D&I projects organized and managed by the cluster project manager and collaborative R&D&I projects between cluster members organized and managed by individual members (Table 6). A significantly less widely used form of cooperation is the open cluster center model for industrial R&D&I (individual facilities are owned by the cluster).

Table 6 Models of cooperation between firms and RO/UNIV

| Models of cooperation | Very | | | | |
|---|-----------|-----------|------------|----------|-------------|
| | important | Important | Moderately | Slightly | Unimportant |
| a) collaborative R&D&I projects organized and managed by cluster project manager | 40 | 30 | 0 | 10 | 20 |
| b) collaborative R&D&I projects between cluster members organized and managed by individual members | 30 | 40 | 10 | 10 | 10 |
| c) open cluster centre for industrial R&D&I (individual facilities are owned by the cluster) | 0 | 30 | 10 | 10 | 40 |

Source: own elaboration based on interviews with cluster managers

Figure 9 shows that the most important activities carried out by researchers when cooperating with cluster organization and its members include conducting research and consulting. On the contrary, the least frequent activities include management/administrative services and trainings.

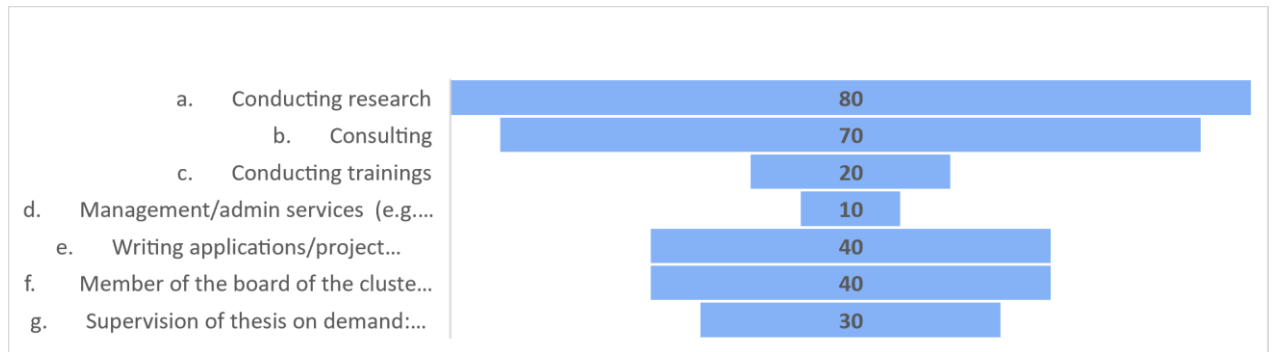


Figure 9 Tasks/activities carried out by researchers when cooperating with the cluster organization and its members

Source: own elaboration based on interviews with researchers

Figure 10 shows that 70 % of the researchers responded that the most extremely important activities within the cooperation with the cluster organization include unambiguously international and domestic research-related projects. 40% of the researchers consider as the most important activities international and domestic education-related projects. The surprising result is that half of the researchers consider staff mobility (incoming or outgoing) to be not relevant.

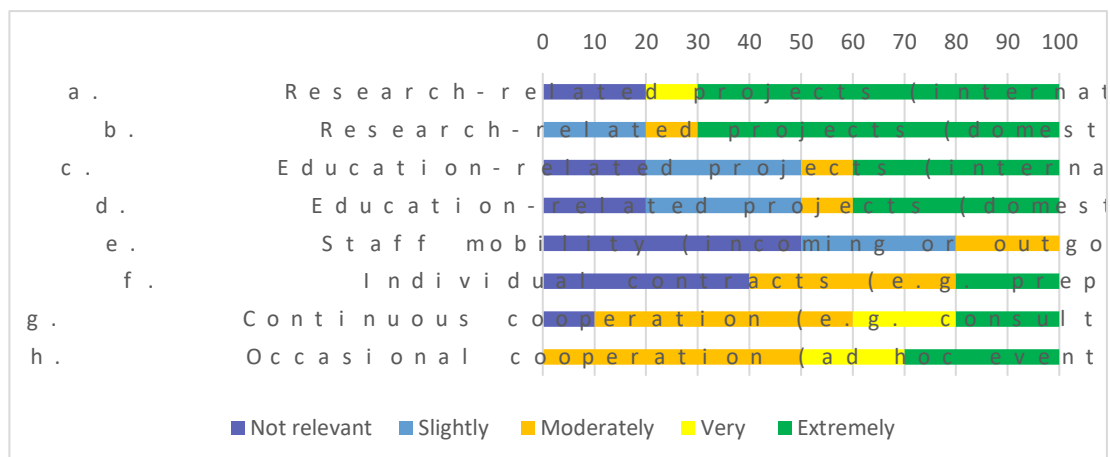


Figure 10 The relevance of the forms in cooperation of researchers with the cluster organization

Source: own elaboration based on interviews with researchers

This part of the research clearly confirmed the greatest importance of research-related activities in cooperation of researchers with the cluster organization (Figure 11), where 70% of the researchers confirm research-related activities as the most significant. 20% of the researchers confirmed the great importance of education-related activities.

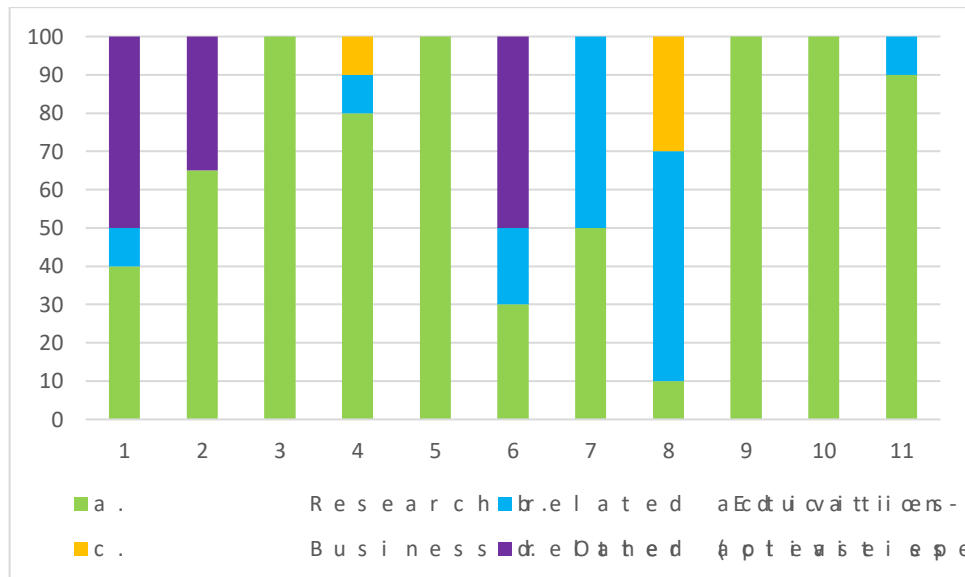


Figure 11 Activities profiles that indicate the time each of them occupies with respect to the organization of the collaboration of researchers with the cluster organization and its members (100 points divided)

Source: own elaboration based on interviews with researchers

The most common applied models of cooperation in R&D cooperation with the cluster organization are collaborative projects managed by the cluster organization or by the university / research organization (Figure 12). Significantly less used models of R&D cooperation are projects managed by other members of the cluster organization.

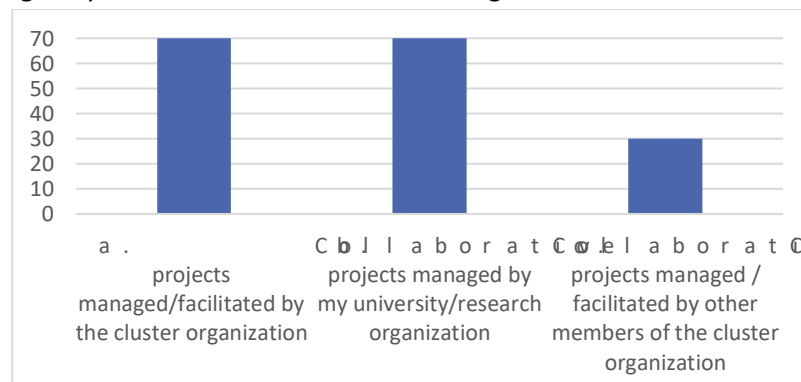


Figure 12 Models of R&D cooperation with the cluster organization and its members (% of respondents)

Source: own elaboration based on the interviews with researchers

Factors conditioning B2R/R2B cooperation in cluster organizations

The results in Table 7 show that the factors that facilitate collaboration between business and research institutions in selected Czech cluster organisations can be divided into three main factors: 1) financial, 2) human resources and relationships, and 3) facilities related to the sectoral similarity of activities between business and research organizations. Thus, these groups unambiguously support the three essential preconditions for creating production in any economy, labour, land, and capital. The first group of factors is the most crucial facilitator of collaboration (70% of the respondents), providing financial resources that support collaboration in terms of the cost of services and products, while providing rewards for researchers. The second group of factors is significantly related to human relations and available human resources, particularly by the factor of mutual trust and (70% of the cluster managers) communication between the cluster members (50% of the respondents). Personal exchange also appears to be a facilitating factor (70% of the cluster managers). The third group of factors relates to the similarity of interests between cluster members, particularly equipment and cross-sector similarities (60% of cluster managers). These similarities then result in the facilitating factor of enhancing reputation / prestige (50% of the respondents).

Table 7 Factors facilitating cooperation between business and research institution within the cluster

| Factor | Significantly facilitates | Facilitates | Neutral |
|--|---------------------------|-------------|---------|
| a) Financial resources | 70 | 20 | 0 |
| b) Human resources | 40 | 30 | 30 |
| c) Facility | 30 | 60 | 0 |
| d) Capacity constraints of R&D&I in SMEs | 30 | 10 | 0 |
| e) Geographic proximity | 10 | 40 | 50 |
| f) Communication between cluster members | 50 | 40 | 10 |
| g) Mutual trust (and personal relationships) between cluster members | 70 | 30 | 0 |
| h) Cross-sector differences | 0 | 40 | 40 |
| i) Cross-sector similarities | 0 | 60 | 40 |

| | | | |
|---|----|-----------|----|
| j) Organization interests and culture (differences between the world of RO/UNIV and industry) | 0 | 0 | 50 |
| k) Organization structure (RO/university administrative structure and firm structure) | 0 | 10 | 40 |
| l) Cost of collaboration due to administrative overheads | 10 | 10 | 50 |
| m) Capacity and fields of research of RO/UNIV in relation to needs of firms in the cluster | 20 | 20 | 30 |
| n) Personnel exchange | 10 | 70 | 20 |
| o) Enhancement in reputation/prestige | 20 | 50 | 30 |

Source: own elaboration based on the interviews with cluster managers"

Figure 13 shows the structure of the responses of individual cluster managers to the primary financial sources for collaborative R&D&I projects in the last three years on average. The survey results indicate a predominant influence of public sources in most cases. In contrast, only two managers declared a share of public sources below 50%. On the one hand, this result shows the importance of public sources in supporting applied research in the Czech Republic. On the other hand, it leads to a discussion on increasing the share of private sources in the context of awareness of the need for private entities to invest in R&D. However, it should be noted that SMEs have limited personnel, technical and knowledge capacities to create radical product innovations. In addition, the Figure 13 shows that membership fees have very limited capabilities to support collaboration on R&D&I projects and thereby they could be considered as source for the cluster management operations.

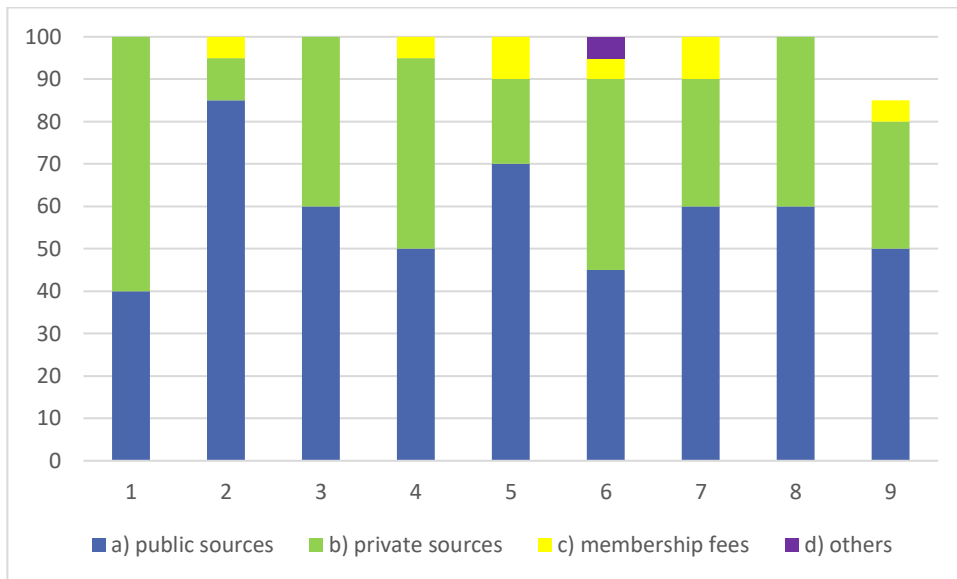


Figure 13 Financial sources for collaborative R&D&I projects in the last three years in average

Source: own elaboration based on the interviews with cluster managers

Figure 14 reveals the differences between the funding sources for the cooperation of research institutions with cluster organizations in the Czech Republic. Researchers consistently report in 50% of cases their own sources of two parties of research cooperation, i.e., cluster organisations and university/research organisations. However, it should be noted that the selected research institutions are mainly made up of public universities. For research institutions, such activities are expected due to their assumed link to the different actors of the regional innovation system considering their applied research activities. On the other hand, through their financial inputs, public universities realise their third role, leading to the production of patents as recognisable R&D results due to their evaluation at the national level. On the contrary, there was a shallow response rate from research institutions (10%) to research collaboration funding from companies. However, as discussed in Figure 13, it is necessary to consider here that the willingness of business institutions to fund research collaboration from their resources depends first on their size in terms of the number of employees and sequentially on their expectation that their membership in cluster organisations will bring them savings. Thus, they reduce their sunk costs on research infrastructure. The reduction thereby subsequently leads to cutting the cost per unit of production and increasing the number of products, an economy of scope. The results of Figure 14 also confirm the long-standing problem of Czech R&D&I institutions, namely the low share of its funding from international sources, especially from EU funds. Therefore, we can argue that research cooperation in cluster organisations lacks an international dimension. As 60% of their research institutions representative stated, this is being replaced by domestic resources in R&D&I (Programs of the Ministry of Industry and Trade, the Czech Republic Technology Agency, Regional Innovation Vouchers). However, domestic resources for research collaboration in cluster organisations should be considered as the first level of financial sources

for research cooperation that is supposed to result in increased competitiveness of business entities and participation of universities and research institutions in applied research. The inverse relationship was identified in the case of education-oriented research cooperation, where there is a dependence on ERASMUS and other less demanding programmes in demonstrating their excellence.

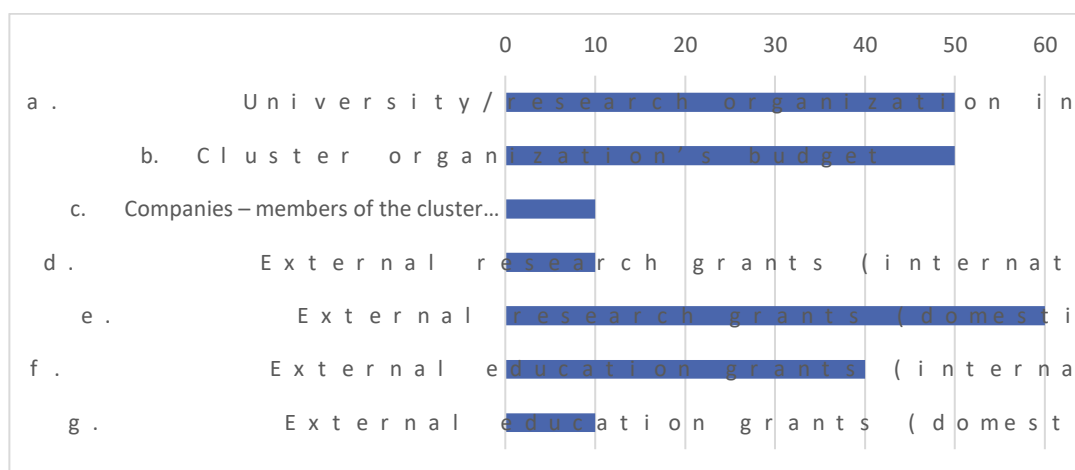


Figure 14 Most important funding sources for researchers' cooperation with the cluster organization and its members in the last 3 years (% of respondents)

Source: own elaboration based on the interviews with researchers

Figure 15 provides a view of the diversified structure of research collaboration results in cluster organizations from the perspective of the representative of the selected research institution. The dominant results of the cooperation are the acquisition of domestic grants, which was mentioned by 70% of the respondents. The acquisition of international grants and the preparation of project proposals (50% of responses) account for a slightly lower share. Both results must be considered as prerequisites for further R&D results in financing their operating and overhead costs. The results of research cooperation in cluster organizations are reflected in 1) measurable results of cooperation evidenced by annual statistical reports of R&D results; 2) measurable results of cooperation based on the discretion of the recipient of the research result; 3) measurable results in the field of education in R&D, 4) explicitly unmeasurable results of cooperation, depending on the subjective evaluation of the participants in the cooperation. Exploring the partial results included in group 1, the same share of the researchers' responses was found in the case of scientific papers and/or monographs and other publications (eg, research reports). These results are significant for the evaluation of public universities. Such findings raise the question of how beneficial these results are for business institutions in research collaboration within a cluster organization.

In contrast, Figure 15 shows a lower proportion of outcomes for both business institutions and universities/research institutions in Group 1. These are made up of patents and prototypes,

mentioned by 30% and 40% of the research institutions representative, respectively. However, it should be emphasized that not all research collaborations between these cluster members are focused on patent or prototype research, especially when it comes to service innovation rather than a tangible product. These results of research cooperation are pointed out mainly by the group of results 2, represented by different types of innovations. Figure 15, in this case, shows the predominance of product innovations (services and products) reported by 50% of the respondents. These relate to sunk cost savings and externalization of operating and overhead costs for public resources or the resources of the cluster organization. A lower share of responses was achieved in results focused on the marketed product/service and trademarks (20%). Outsourcing can explain this issue due to the availability of many specialized business institutions on the market and lower R&D costs. The share of business innovations and presentations in the results of research cooperation is low. This situation can be explained by the high competition in the market for these types of services, their limited public support, lower cost requirements, and the protection of trade secrets in the case of business innovations. The results of the research cooperation in group 3 reflect the cooperation in the field of qualification work of students (master or Ph.D. theses). This type of cooperation is win-win cooperation, organizationally and financially less demanding for the participating parties, which is documented by a 50% share of respondents. The lower share in group 3 is associated with the training of the cluster members (30% of the respondents). Here, one can mainly consider the training of business institutions members through RO/UNIV. The lower share of this result may be due to the time required for training, the time available to researchers due to their additional responsibilities, the intensity of demand from business institutions, and the benefits of formal training on transfer and knowledge sharing in in-house research. The fourth group of results is represented by an indicator, extending my network, mentioned in 60% of the cases. This situation indicates the positive externalities of research cooperation with considerable opportunities for further expansion.

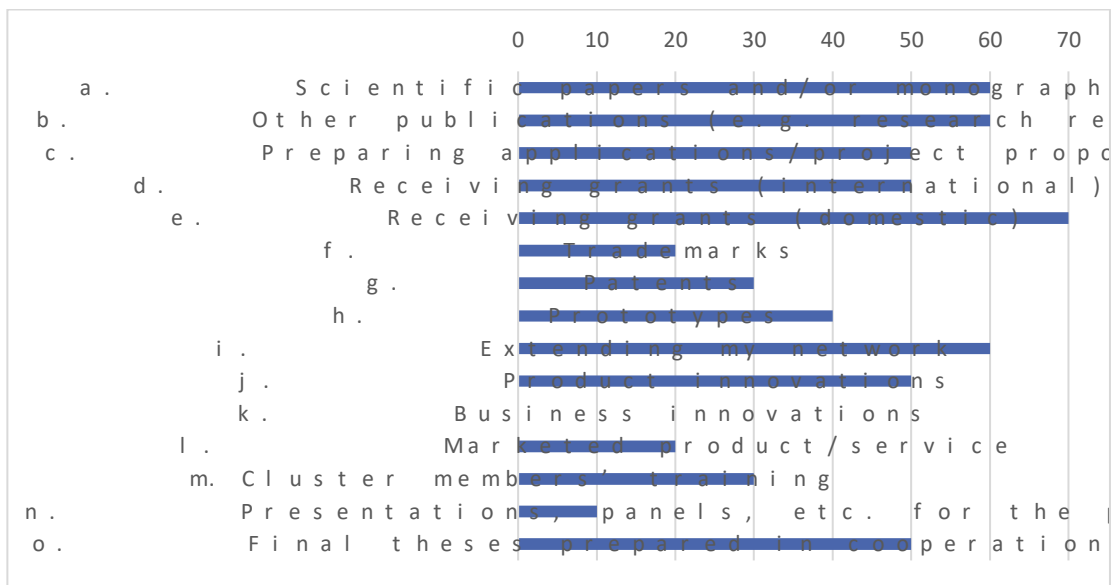


Figure 15 Results associated with cooperation of researchers' with the cluster organization and its members (% of respondents)

Source: own elaboration based on the interviews with researchers

Challenges and barriers for B2R/R2B cooperation

Table 7 provides an overview of the responses of the Czech cluster managers to facilitate cooperation between research and business institutions within the cluster. In contrast, Table 8 first highlights the neutral factors and then the factors that hinder the cooperation between these two actors among the members of the Czech clusters. In particular, geographical proximity (50% of the respondents) can be identified as a neutral factor for cooperation. Its importance decreases with the progressive digitalisation communication due to the measures and impacts of the COVID-19 pandemic. Similar neutral assessments of the collaboration factors were confirmed for the factor of organisational interests and culture (differences between the world of RO/UNIV and industry), indicating in half of the respondents a uniformity in the respondents' views and their ability to overcome this factor. A surprising result is the 50% share of neutral evaluations of cluster managers in the case of the cost of collaboration due to administrative overheads. This cost appears to be even more acceptable than the factors 1) organisation structure (RO/UNIV administrative structure and firm structure), and 2) the second half of respondents' views on the factor organisation interests and culture (differences between the world of RO/UNIV and industry). These factors point to the different interests of business institutions, for which profit is the primary concern, and research institutions, which are overwhelmingly recruited from public universities. However, the latter are evaluated on criteria other than profit and have to diversify their activities between teaching, primary, and applied research. Another significant problem that hinders cooperation between business and research organisations in Czech cluster organisations appears to be the complex decision-making process and management of public universities, given their two-tier structure (faculties and rectorate) and internal regulations.

Table 8 Factors hindering cooperation between business and research institution within the cluster

| Factor | Neutral | Hinders | Significantly hinders |
|--|---------|-----------|-----------------------|
| a) Financial resources | 0 | 10 | 0 |
| b) Human resources | 30 | 0 | 0 |
| c) Facility | 0 | 10 | 0 |
| d) Capacity constraints of R&D&I in SMEs | 0 | 40 | 20 |
| e) Geographic proximity | 50 | 0 | 0 |
| f) Communication between cluster members | 10 | 0 | 0 |
| g) Mutual trust (and personal relationships) between cluster members | 0 | 0 | 0 |
| h) Cross-sector differences | 40 | 20 | 0 |

| | | | |
|---|----|-----------|----|
| i) Cross-sector similarities | 40 | 0 | 0 |
| j) Organization interests and culture (differences between the world of RO/UNIV and industry) | 50 | 30 | 20 |
| k) Organization structure (RO/university administrative structure and firm structure) | 40 | 30 | 20 |
| l) Cost of collaboration due to administrative overheads | 50 | 30 | 0 |
| m) Capacity and fields of research of RO/UNIV in relation to needs of firms in the cluster | 30 | 30 | 0 |
| n) Personnel exchange | 20 | 0 | 0 |
| o) Enhancement in reputation/prestige | 30 | 0 | 0 |

Source: own elaboration based on the interviews with cluster managers

The best practices of B2R/R2B cooperation in cluster organizations that can be transferred and implemented in other V4 countries

Based on interviews with cluster managers, we identified several parallels in best practices of R&D&I cooperation between firms and RO/UNIV within clusters. Joint projects leading to new technologies were among the most preferable practices for nurturing R&D&I cooperation. The managers highlighted activities related to the networking between firms and RO/UNIV, with systematic approaches to monitor the needs and demand of members to cooperate. Maintaining cooperation between firms and RO/UNIV is also achieved through projects supporting student internships as part of human resources development within clusters. In addition, clusters often participate in matchmaking events to align the needs and opportunities for members to advance R&D&I cooperation. Events are regularly organized internationally to connect various stakeholders with webinars, workshops, and conferences. Generally, the above-mentioned activities are crucial to 1) initiate, 2) develop, and 3) maintain B2R and R2B in a wide-ranging way. We identified detailed best practices for R&D&I cooperation between firms and RO/UNIV comprising a short summary, overview, resources needed, timescale, evidence of success, challenges that occurred, and potential for learning or transfer in Tables 9 and 10.

Table 9 Description of best practice 1

| Detailed description | |
|--|---|
| Short summary of the practice: | Establishing the center of experts (experts from both academia and industry) to generate R&D ideas and develop joint research projects |
| Detailed information on the practice: | Generating ideas for formal and informal meetings based on brainstorming/sharing ideas within the group of more than 80 companies, which eventually leads to identifying experts for specific research topics. Each research topic has an expert from industry and academia to combine practical and theoretical knowledge. This practice serves as a communication platform to share best practices in the automotive industry. Additionally, this practice addresses the lack of communication and cooperation between companies and research infrastructure (B2R/R2B) by establishing the centre of experts. The center of experts helps to generate new project ideas for national/international project frameworks. The lack of systematic cooperation of B2R/R2B triggered the introduction of the practice, while the main stakeholders and beneficiaries of the practice come from both the |

| | |
|--|---|
| | private and public sector. Join research project combine expertise of practitioners and researchers to engage in R&D&I with matchmaking activities linking various stakeholders in the process. The Join platform serves as a tool to maintain contact with researchers and researchers in the autoregative sector with an outlook on real capacities and opportunities to engage RO in projects. The practice also revolves around mediating activities focused on needs of companies and opportunities for universities in joint activities. |
| Resources needed: | The financial resources used for the practice are negligible as the platform is financed by internal sources for meetings/gatherings. More importantly the practice revolves more around human resources to make it efficient, preferably linking diverse stakeholders from both private and public sectors to run the practice. |
| Timescale (start/end date): | Recurring practice that does not have a certain schedule, more frequent, the better outcomes from brainstorming/matchmaking activities. |
| Evidence of success (results achieved): | Generating projects to increase competitiveness of companies in the automotive industry under the Operational Programme Enterprise and Innovations for Competitiveness based on B2R & R2B cooperation in the cluster. |
| Challenges encountered | Overcoming organizational interests and culture, especially differences between private and public sectors (industry and RO/UNIV differences) along with organizational structures (differences concerning administrative structures). Matchmaking and pinpointing experts require human resources and mutual trust. |
| Potential for learning or transfer: | This practice can be implemented in clusters seeking the participation of various stakeholders (members) by setting up a similar centre of experts on specific topics for brainstorming/matchmaking ideas. Key success factors for a transfer are to tap into human resources of clusters and to create a common communication platform to share ideas and pinpoint specific topics for joint projects (internal, national, international). The lack of mutual trust/interest could potentially hamper practice. Additionally, this practice requires overcoming differences in organizational interests (differences in scope of |

| | |
|---|---|
| | activities firms/research organizations) and cultures (private/public sectors). |
| Keywords related to the practice | Matchmaking, experts, communication platform |

Source: own elaboration based on interviews with cluster managers

Table 10 Description of best practice 2

| Detailed description | |
|--|--|
| Short summary of the practice: | Working groups for multistage discussion on R&D project with internal peer review (informal teams) linking stakeholders for international cooperation |
| Detailed information on the practice: | This practice addressed the issue of systematic collaboration between disconnected groups in the cluster. The context that triggered the practice is subject to the inability to connect professionals with expertise to develop R&D&I projects. The practice reached its objective by creating working groups combining practitioners, early career researchers, and doctoral students with internal and international meetings to set up consortium for projects. Additionally, it is implemented and developed by multistage discussions comprising 1) discussion (project ideas; 2) development of proposals; 3) implementation; 4) evaluation. The main beneficiaries of the practice are working groups developing R&D&I projects with internal peer review in an informal environment to international projects with diverse stakeholders. Furthermore, diverse working groups are based on networking and monitoring needs/demand of members to cooperate and develop new project ideas. The practice maintains complex R&D&I projects, establishing spin-offs and research capacities for joint research and projects for new technologies. |
| Resources needed: | The practice requires human resources in project management and capacity (especially project support to aid each process) in multi-stage discussions. Financial resources depend on the size, expertise, and location of working groups. Internationalisation of working groups and their activity requires internal funding that can eventually move to public funding from international projects. |
| Timescale (start/end date): | Depends on the scale of projects and internationalisation activities in R&D&I |
| Evidence of success (results achieved): | Active participation in H2020 projects with knowledge sharing in working groups, along with joint projects leading to new technologies and patents that would be difficult to achieve without cooperation between firms and RO. |
| Challenges encountered: | The practice requires networking and monitoring needs/demand of members. The challenge feature is reflected in the nurturing of an informal atmosphere and communication channels. Additionally, the practice is a long-term process consisting of multistage discussions/meetings, which require human resources |

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| | (sharing employees between organizations) and time to accommodate differences in organizational processes and cultures. Overcoming barriers to mutual trust is essential to create a network of stakeholders for the sharing of knowledge and information sharing |
| Potential for learning or transfer: | The practice is potentially interesting for clusters aiming to develop internationalisation activities through international projects that require a diverse pool of stakeholders. This can be done through knowledge/employees sharing between companies and RO, linking industry with academic sector to create multi-stage processes of project development (firstly internal than international). A key success factor for practice is the informal environment and communication channels to establish and maintain working groups with regular internal meetings and peer review of project proposals. Internationalization in project reflects on sharing contacts and expertise (tacit knowledge in project development, implementation, evaluation) and systematic internal peer review processes to achieve research excellence in the long run. |
| Keywords related to the practice | Working groups, multistage discussion, peer review, informal environment |

Source: own elaboration based on interviews with cluster managers

Conclusions and recommendations

Cluster managers and researchers indicated the following issues as the most important benefits for the development and support of cooperation between firms and RO/UNIV, which have been achieved with the help of the cluster organization.

- creation of framework for cooperation between firms and RO/UNIV
- development of communication between firms and RO/UNIV
- access to EU funding, possibility to use grant schemes of the Operational Programmes and Technology Agency of the Czech Republic
- Strengthen the role of RIS3 strategies in the development of cooperation,
- cooperation with the Ministry of Industry and Trade,
- long-term contacts for B2R/R2B cooperation, increasing mutual trust, maintaining cooperation, verifying model of activities,
- maintaining contact with universities and getting to know real capacities and opportunities for cooperation of firms with universities;
- Ability to identify cross-sectoral opportunities, access to unique know-how and key technologies, matchmaking for R&D, sharing research topics, cost savings,
- impact on the effectiveness of project facilitation, help with the administrative burden of project management,
- involvement of SMEs in projects, they are able to learn to process their own projects,
- Human resources development.

The cluster managers interviewed indicated the following recommendation to improve the cluster policy to support the clusters:

- Support for the cluster in general (policy programmes/documents), more targeted support, maintaining the cluster cooperation programme.
- shift of competences from national bodies to regional (closer to clusters) - project framework, finance, activities; development of regional policies and programmes to support research cooperation/cluster development; more targeted financial support for regions (regional programmes); activation of regional stakeholders and identification of specific persons at regional level to implement cluster policies,
- easier administration in proposals and projects to receive public support; less administrative burden and access to qualified personnel for administration, to minimize changes during implementation periods; to minimize staff changes
- administration and allocation of resources in R&D with sector focus, coordination of activities between grant institutions,

- align interests, especially to join efforts of MIT, CzechInvest, and NCA and their relation to cluster organizations (simplify the process) to sustain conditions for cooperation.

B2R/R2B cooperation requires targeted, intelligent, and deliberate support, based primarily on better mutual knowledge and understanding of both parties. Clusters represent one of the important platforms for cooperation between firms and research institutions. Within the framework of the project "Clusters as platforms for business-research (B2R)/research-business (R2B) relations supported by the Visegrad Fund, this report confirms importance of support of cooperation between firms and research institutions (B2R/R2B) in the territory of the Czech Republic. This report presented specific answers to the questions of motives for cooperation, determinants shaping cooperation, identification of forms of cooperation, and presentation of selected best practices. Several recommendations were provided to improve the cluster policy as a tool to accelerate this cooperation.

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