



STATUS QUO REPORT AND IMPACT ASSESSMENT



**The Role of Knowledge Centres in the R&D Ecosystem
and the Network Model of Knowledge Sharing
– Regional “Redevelopment” in Central Europe**



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Summary

We are applying for a *European cooperation project* within the framework of the 2021-2027 funding round of the *Creative Europe programme*. With the funding available under the *Culture* strand of this European Union programme, we intend to implement a medium-sized cooperation project with participants from Central and Southern Europe. The proposed project will focus on regional redevelopment, which would be supported by the knowledge centres in the region by creating an R&D and knowledge-sharing ecosystem. We plan to use several approaches to achieve this “redevelopment”. In particular, *cultural heritage* will be highlighted as a potential and available regional resource, the exploitation of which would significantly contribute to the development of the region. Secondly, we believe that *the sharing and utilisation of new knowledge* can also be a factor in regional development and that knowledge centres in the macro-region can play an important role in this effort. Another key objective is to increase the resilience of regions and society. To achieve this goal, the involvement of local communities – through grassroots initiatives – is also essential and necessary. This *Status Quo Report and Impact Assessment* serves as a starting point towards the achievement of the objectives outlined above, exploring both the theoretical underpinnings of the R&D ecosystem and its practical implications by presenting the current operation, networks and practices of the knowledge centres involved in the partnership.

Introduction

The research and development (R&D) ecosystem is regarded as a complex system of networked knowledge producers working together to increase both the efficiency of knowledge production and sharing knowledge to contribute to the development of the region. The relevant literature also mentions *cross-organisational innovation* in this context, which refers to new knowledge being shared between geographically dispersed disciplines and other types of organisations.¹ Knowledge transfer ecosystems are also understood to be *inter-organisational R&D&I cooperation networks*, whereby alliances are formed between different regional actors to integrate scientific, technical and economic knowledge into knowledge creation and sharing processes. The actors in this ecosystem can include profit-oriented industrial players, universities, knowledge centres or governmental/regional decision-makers.² The domestic literature on this topic also uses the concept of *innovation ecosystems* to describe this innovation environment. One important characteristic of this environment – ecosystem – is that it is geographically concentrated. A science or innovation park is a great example of an innovation ecosystem. As a framework, an ecosystem serves the purpose of enabling different actors to cooperate in the common mission of producing and sharing knowledge.³

The literature offers further concepts related to and detailing types of R&D ecosystems, which will be discussed in more detail in the theoretical background section. In addition to discussing theoretical issues, we will also introduce those organisations – alongside their cooperation networks – that already participate in knowledge-based activities which more or less fit into the above concepts and represent the mission of the R&D ecosystem in practice. Furthermore, these organizations intend to participate in this cooperation within the framework of a European cooperation project financed by the 2021-2027 funding round of the *Creative Europe* programme. The partners involved in this process of collaboration are located in Central and Southern Europe and will act as knowledge centres well as partners in the planned project. The current operation of these organisations reflects the status quo of present-day *knowledge-based cooperation models*.

¹ Jane Millar – Adrian Demaid – Paul Quintas (1997): *Trans-Organizational Innovation: A Framework for Research, Technology Analysis & Strategic Management*, 9, 4, 399-418.

² Zoltán Csedő – Gábor Pörzse – Máté Zavarkó (2021): *Innovation Knowledge Networks in Higher Education: Experiences of the Development of a Power-To-Gas Innovation Ecosystem. Pro Publico Bono – Magyar Közigazgatás (translation: Ministry of Public Administration, Hungary)*, 2021/3, 6-31. • DOI: 10.32575/ppb.2021.3.1

³ Csilla Tóth – András Hány (2023): *Analysis of the Settlement Intensity of Innovation Ecosystems. Marketing & Menedzsment (Translation: The Hungarian Journal of Marketing and Management)*, 2023/2, pp. ? • DOI: 10.15170/MM.2023.57.02.01.

Meanwhile, in an attempt to explore the characteristics of these knowledge-based collaborations in a structured manner, we defined a set of criteria based on which the contacted knowledge centres – our future partners – participated. The fulfilment of these criteria was examined with a series of questions.

Since our first priority was to identify the profile of the knowledge centre (knowledge-based regional actor) to be involved in the partnership, we requested information concerning the thematic focus of the partner institution. To achieve this, we created a list of questions regarding the research areas, institutional profile and different specialisations of the knowledge centre as these characteristics reflect the functions and sectoral orientations of the regional actors in the R&D ecosystem, which may include areas of technological, social or cultural innovation.

The next question (criterion) was targeting how the knowledge centre is linked to the higher education institutions and human resources in the region. Are there regularly organised workshops and events to facilitate collaboration between the different actors involved in knowledge-based activities? Are there joint projects and collaborations between the knowledge centre and higher education institutions in the region which have been (or are being) carried out to stimulate territorial development?

If there is a knowledge network in a given region, we think it is important to identify the specific functions of the actors in the network. For this reason, we asked the knowledge centre involved in the partnership about their specific role in the development and operation of the knowledge network, which could involve providing venues, performing organisational tasks as well as implementing independent initiatives or projects.

Decision-makers are essential actors in the implementation of territorial development initiatives. With this in mind, we asked how effectively the knowledge centre in the given region can cooperate with governmental actors and territorial development organisations. However, our focus was not limited to the local level; regional, national and international relations were also considered as we believe those also play a crucial role.

When it comes to the operating model of the knowledge networks, mapping the practical steps involved in the process of knowledge sharing in the region – the actions of which can be expected from the participants – is also essential. Therefore, we asked the knowledge centre involved in the partnership to explain how it would describe this process and what the concrete steps that make up the knowledge-sharing processes in the region are. The description of the practical steps and the process of knowledge sharing can be taken as examples, that is, methods to be adapted by other regions as good practices.

Meanwhile, we also sought those successful cooperation models that the knowledge centre has developed together with other regional knowledge-based actors. Here, the emphasis was on the techniques and methodology of successful cooperation rather than on the content of individual projects and the results of their implementation.

Given that the prospective partnership would take place within the framework of the *Creative Europe* programme, we were also curious about the creative and cultural aspects of activities in the regional knowledge networks. In this regard, we expected future partners to present creative methods, approaches and innovative processes that they would utilise in their own activities while participating in the knowledge network in their region.

Towards the end of the questionnaire, we also asked questions about specific projects aiming to achieve regional development objectives in the regions of the knowledge centres. However, in terms of these projects, we were only concerned with programmes in which the knowledge centre in question had played an active role.

Finally, we asked the knowledge centres which traditional as well as innovative/creative techniques and methods were used by each knowledge actor in the R&D ecosystem of the region to share knowledge in the region.

The responses to the aforementioned questions received from the knowledge centres invited to participate have served as an input for the *Status Quo Report and Impact Assessment* presented below, which provides a comprehensive analysis of the current models of *R&D ecosystems* and *knowledge networks* in the different regions.

R&D ECOSYSTEMS & KNOWLEDGE NETWORKS

Innovation capacity, higher value-added activities, economic growth and sustainable development: for less developed countries, these goals are becoming increasingly important. Although the road to catching up with developed countries is a long one, *innovation ecosystems* can provide significant support to achieve these goals. While there is no consensus in the literature on the precise meaning of the concept of innovation ecosystems, all experts agree that the key element of the concept is *cooperation* between the different actors active in the region. Who are the actors that can participate in this form of cooperation? The domestic literature utilises Etzkowitz's model, among others, which lists the following three categories of actors when discussing innovation ecosystems: the *state*, the *business sector (companies)* and *higher education institutions*. The cooperation of these actors is generally focused on the creation of a knowledge-based economy and a modern economic structure.

The framework for this cooperation is an ecosystem, which, as an organisational system, can also take on an *institutionalised form*.⁴ This ecosystem, like biological ecosystems found in nature, is comprised of *spatially or structurally connected* actors and their relationships with their environment. In nature, such ecosystems aim to maintain a sustainable state of equilibrium, whereas innovation ecosystems seek to achieve economic growth. First, the term “*business ecosystems*” was used to describe cooperative ecosystems in the economy. As early as the early 1990s, James Moore, an American organisational researcher, was concerned with economic and business communities whose actors interact with each other in order to succeed together as well as adapt to external and internal changes. To describe these communities, Moore applied the concept of business ecosystems, which later spread to the fields of business and management sciences. The concept of an innovation ecosystem, however, only appeared in the literature later, in the 2000s, and, although not immediately, the concepts of business ecosystems and innovation ecosystems gradually became distinct.⁵

While the term a “business ecosystem” refers to the business sector – businesses and consumers – and focuses on generating profit, an innovation ecosystem includes not only businesses but also higher education institutions, research centres and civil society. It is also important to stress that innovation ecosystems aim to *create value*.⁶

The need for an ecosystem can be interpreted from two approaches. The first is *strategic*, where the ecosystem is regarded as a strategy. In this sense, an innovation ecosystem is a set of *processes and instruments* that contribute to the development and maintenance of relationships between stakeholders as well as to the positioning and value creation capacity of individual stakeholders.⁷ When an ecosystem is regarded *as a structure*, the *framework* (organisational system) and *cohesive force* that ensures that actors can work together in the long term is focused upon.⁸ Indeed, the fundamental requirement of an innovation ecosystem is to increase the capacity of its participants to work together.⁹

⁴ Horváth, Klaudia (2021): *The Increasing Importance of Innovation Ecosystem Research: a Science Metrics Analysis of the Topic*. *Köz-Gazdaság – Review of Economic Theory and Policy*, 16(4), 237-258.

⁵ Horváth, Klaudia (2021): *Structural Challenges of Innovation Ecosystem Management – In the Light of the Literature*. *Management & Marketing*, 55(3), 71-81. DOI: 10.15170/MM.2021.55.03.06

⁶ Valkokari, K. (2015): *Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them*. *Technology Innovation Management Review*, 5(8), 17-24.

⁷ Adner, R. (2012): *Wide Lens – a New Strategy for Innovation*, London: Portfolio Penguin.

⁸ Adner, R. (2017): *Ecosystem as Structure: An Actionable Construct for Strategy*. *Journal of Management*, 43(1), 39-58. DOI: 10.1177/0149206316678451

⁹ Gamidullaeva, Leyla (2018): *Towards combining the innovation ecosystem concept with intermediary approach to regional innovation development*. *MATEC Web Conf., International Scientific Conference “Investment, Construction, Real Estate: New Technologies and Special-Purpose Development Priorities”, Volume 212*. DOI: 10.1051/mateconf/201821209017

Examples of concrete innovation ecosystems include *science and innovation parks*. The first of these types of institutions - *Stanford Research Park*, established in 1951 in California, USA - is often referred to in the literature as well as the world's first university research park and the "epicentre of Silicon Valley". In fact, the purpose of these parks is to promote the utilisation of scientific results in the economy and increase the diffusion of innovation. Of course, countless such institutions are in operation today, with hundreds of innovation parks in the European Union alone. However, they are diverse in terms of their institutional form as well as operating and funding models. What are the functions and roles of such parks mentioned in the literature? Their main function is to facilitate the flow of knowledge and technology between universities and the economy. It is also important to stress that these parks are an environment that creates a culture conducive to innovation and creative activities. Furthermore, they focus on the knowledge economy as well as play a role in developing the international competitiveness of businesses. Another important objective is to be able to improve communication between universities and economic actors.¹⁰ However, the scope of these functions may vary from one park to another, depending on the type of institution to which they belong. Some authors classify these institutions as *science parks*, *technology parks* or *research parks*. International researchers have also used terms such as *research sites*, *collaborating centres* and *incubators* to describe institutional forms of innovation parks.¹¹

However, the type referred to as a "*Regional Innovation Ecosystem*" (RIE) should also be specifically mentioned, as it is in this form of cooperation that the explicit role of universities – also referred to as "the Third Mission of universities" – is expressed. This role aims to create a culture focused on social and economic development, with knowledge as its main pillar and main asset. The regional innovation ecosystem is also based on the so-called *knowledge triangle* or *triple helix model*, which models cooperation between universities, businesses and governments to boost economic development and competitiveness. The model places a strong emphasis on research, education and innovation. In a regional innovation ecosystem, *regional knowledge sharing* and *regional innovation capabilities* can also be discussed, which, in some cases, can even bring about social changes. The network culture as well as the roles and responsibilities of the different actors in the cooperation framework are very important. Most importantly, it is critical to underline that the aim of cooperation is to increase the innovative capacity and competitiveness of *the region*.¹²

¹⁰ Vasvári, Bálint–Mayer, Gábor–Vasa, László (2020): *The role of science and innovation parks in the development of innovation ecosystems*. *TÉR GAZDASÁG EMBER* (Translation: *Space, Economy and Man*), 2020/2, 8, 95-107.

¹¹ Ng, W.–Appel-Meulenbroek, R.–Clodt, M.–Arentze, T. (2019): *Towards a segmentation of science parks: A typology study on science parks in Europe*. *Research Policy*, 48, 3, 719-732. <https://doi.org/10.1016/j.respol.2018.11.004>

¹² Kálmán, Anikó (2019): *The role of the regional ecosystem and universities in the innovation process*. *Iskolakultúra* (Translation: *School Culture*), Volume 29, Issue 2019/9. DOI: 10.14232/ISKKULT.2019.9.51.

The “*Quadruple Helix model*” refers to the case when, in addition to the actors listed above, the *civil sector* is also involved in the cooperation models discussed.¹³ Meanwhile, the range of actors in cooperation models can be similarly extended to include, for example, *knowledge centres*, whose profile and institutional structure are different to that of universities. With such a wide range of actors, cooperation models can now develop into complex *knowledge networks*.

In relation to *knowledge networks*, some authors point out firstly that the innovation process itself is not shaped by a single actor acting in isolation, making decisions on its own, but by the combined actions and decisions of many actors. The proximity of the actors (institutions) in the local knowledge flows provides the critical mass needed to promote the development of the region. However, examples where the relevance of spatial proximity is undermined can be found; some networks grow *beyond* the individual regions themselves. These networks are called *knowledge networks*. Trans-regional links are often necessary because resources are limited in certain regions, moreover, can be replenished and replaced from outside. These resources can include the critical mass of specific industries, knowledge bases or even actors. In recent years, regional scientific studies have also raised the question of the role that these knowledge networks can play *in regional development*. As a result, the relevant literature has formulated the idea that the development and support of knowledge networks *is a potential direction for development policy*, which can help the region to develop by attracting external resources while strengthening the local base for innovation at the same time. The aim is to promote economic development in the region, especially in disadvantaged areas. However, according to domestic researchers, regional development resulting from knowledge production depends on a number of determining factors. One of these key factors is the size of the region, which also includes employment figures. Naturally, local human capital and the entrepreneurial environment are also important. In terms of R&D, the number of patents and patenting activity must be mentioned. The extent of the presence of the technology sector in the region is also an important factor when it comes to innovation capacity, and – given that knowledge networks are being discussed – the presence and embeddedness of researchers in the region in addition to in the knowledge network, as well as the level of R&D expenditure, are also decisive factors having a significant impact on the knowledge network.¹⁴

¹³ Horváth, Klaudia Gabriella (2021): *Opportunities of Developing Processes of Innovation Ecosystems: The Concept of an Online Innovation Forum*. *Polgári Szemle (Rough translation: The Civil Journal of Social Sciences)*, vol. 17, nos. 1-3, 348-357. DOI: 10.24307/psz.2021.0725.

¹⁴ Hau-Horváth, Orsolya–Sebestyén, Tamás–Varga, Attila (2016): *The role of knowledge networks in regional development – experiences of an integrated model in Hungarian regions*. *Statistical Review*, 94 (2), 117-142, ISSN 0039-0690..

The importance of knowledge networks is also reflected in the literature, which shows that economists consider the way in which the various actors in a knowledge network or region – including higher education institutions, economic actors, other institutions and research institutes – can cooperate with each other as a key factor of international competitiveness. These collaborations contribute to the learning, acquisition and application of new knowledge, even knowledge imported from elsewhere. Recognising their importance, knowledge networks – or R&D collaboration – have been researched since the 1990s and the literature on this type of collaboration has been growing ever since.¹⁵

What are the objectives of these networks? According to Robert Tijssen, a researcher on innovation studies at Leiden University in the Netherlands, networks aim, among other things, to¹⁶:

- increase,
- combine,
- exchange,
- transform,
- acquire,
- and utilise the resources of actors in a formal or informal manner.

Knowledge centres can be seen as key players in the collaboration described above, often playing a role not only in the diffusion of innovation but also in territorial development.

KNOWLEDGE CENTRES

An institutional framework for the dissemination of knowledge is an important contribution towards sustainable economic development. This institutional framework can include a wide range of organisations that support the diffusion of knowledge and technology such as technology transfer organisations, diffusion organisations, business and innovation centres, science and technology parks as well as knowledge centres. Knowledge centres play a role in creating an environment for the local knowledge base and innovative businesses to ensure the optimal flow of knowledge. They also help to create businesses whose activities are based on local knowledge. It should also be stressed that

¹⁵ Csonka, László (2010): *The role of R&D networks in strengthening the knowledge base: knowledge centres in the automotive industry*. Csonka László_vitaanyag_081117 (penzugyutato.hu) Downloaded on 05.03.2024.

¹⁶ Tijssen, R. J. W. (1998): *Quantitative assessment of large heterogeneous R&D networks: The case of process engineering in the Netherlands*. *Research Policy*, Vol. 26, 791-809.

knowledge centres seek to develop local knowledge resources in line with defined strategic objectives. To put it simply, knowledge centres are tools for *active knowledge management*. How do they achieve this? First, they map the (locally) available knowledge before synthesising, processing and organising it, then identifying what can be used and utilised in the given economic environment. Finally, partners are sought to utilise this knowledge together.¹⁷

REGIONAL “REDEVELOPMENT” BASED ON INNOVATION

The cooperation of innovation ecosystems, knowledge networks and their actors can also be focused on common objectives such as *regional development*. In this case, R&D activities not only result in the development of technology, success of individual economic sectors or economic growth, but also in *regional development, the catching-up of regions and an increase in the competitiveness of the region* in the long run. Why are these knowledge-economy players and their cooperation described by the previously mentioned models the driving force behind regional development? The literature on regional development gives a simple answer to this question: because *knowledge* is the most important resource and the main factor attracting capital to the region. Therefore, the aim is to increase, disseminate and exploit this knowledge, which will in turn contribute to the development of the economy in the region. This is why researchers, policymakers and decision-makers focus more and more on regional innovation ecosystems, the factors affecting regional innovation as well as the individual knowledge-based actors and their cooperation. An article in the literature claims that over the last few decades, research universities have been the initiators and central actors of regional economic development (with the United States being cited as a geographical region in this context). These universities have become drivers of economic development by generating new knowledge and marketable innovations before creating technological concentrations in developed countries such as in Silicon Valley. This is how the regional role of the academic sector in particular has emerged – and as a result of these successes, regional scientific research has started to focus more and more on knowledge flows as well as knowledge networks.¹⁸

The aforementioned positive regional trends have led to the emergence of a regional economic policy, the base of which is innovation. Domestic authors also refer to this policy as *innovation-based*

¹⁷ Kádár, Imre (2003): *The role of knowledge centres in innovation and territorial development*. Kádár Imre: *A tudásközpontok szerepe az innovációban és területfejlesztésben (inco.hu)* Downloaded on 2024. 03. 05.

¹⁸ Horváth, Kornélia (2004): *The opportunities of innovation-based regional development in Hungary – The regulatory and financing environment of university research*. *Tér és Társadalom (Translation: Space and Society)*, Vol.18, 2004/4, 29-49.

regional development, which they derive from the United States of America. In the 1980s, many US states adopted regional development concepts that created favourable conditions for innovation and technological development in their regions. To achieve this, they had to take into account the regional conditions for innovation, i.e. the factors that play a role in exploiting innovation potential. The aim was to increase the pool of knowledge available in the regions and the intensity of knowledge flows between actors in the local innovation ecosystem. One pragmatic means to achieve this was to provide huge resources for research to be conducted at universities. Technology centres were also created, consortia signed between universities and industries as well as offices set up to facilitate technology transfer.¹⁹

In his study, Attila Varga refers to the economic policy outlined above as a *regional innovation policy*. Among the important principles of this policy, the author lists the bottom-up approach and partnerships. The results can be attributed to concerted action by actors from local industries, science and authorities. Regional innovation policy also includes phases such as research, technological development, product development and marketing. However, according to Varga, in order for regional innovation policy to be effective in the regions, a number of aspects need to be taken into account. First and foremost, the central government must be willing to cooperate with regional actors, which translates into making a commitment and providing funding (central funding). In most cases – as in the case of the US discussed above – it is also necessary that resources come from the central government, moreover, the regional level should have autonomy in decision-making and the use of resources. Furthermore, regional leaders are needed who are committed to building on local resources. As has already been mentioned on several occasions, cooperation and close partnership between the decision-making apparatus, industrial sector as well as academic and research communities are essential criteria in this context. This, of course, requires openness and trust on the part of all stakeholders. The entrepreneurial culture in the region is also an important factor, as it is the new, innovative businesses that will drive the economic development that is sought. Universities and research institutes also play a key role in regional innovation policy, moreover, their presence and the quality of their work in the region – particularly in the field of technology – are the basis for innovation-based development. Finally, the legal framework and legal system that guarantees the protection of patents and intellectual property are indispensable criteria as well.²⁰

According to international authors, the success of regional innovation systems also depends on a coherent local culture in terms of how much it encourages as well as strengthens knowledge sharing

¹⁹ *ibid.*

²⁰ Varga, Attila (2005): *Regional innovation policy: experiences in the US and opportunities in Hungary. Magyar Tudomány (Translation: Hungarian Science), 2005/7, 857-869.*

and cooperation. The problem may be precisely that this local culture is generally not homogeneous, that is, different cultures in different organisational or sectoral structures may lead to cultural conflicts, perhaps affecting the innovative activities of individual actors. Regional culture is thus often considered to be a determining force for innovation processes. Furthermore, it is difficult to determine how individual actors apply their own innovative practices in a context of multiple overlapping cultural influences. For this reason –although not excessively – researchers have already investigated the links between local cultural systems, the organisational culture of companies and the industrial culture of different sectors.²¹

To create R&D ecosystems, policymakers then tried to model the case of Stanford and Silicon Valley. What these models had in common was that they envisioned research centres and technology-intensive companies locating in the same area, that is, in science or technology parks. As a consequence, entire cities were designated *as science cities* or *technopoles*. While the benefits of these plans have been reported in the literature, shortcomings in these projects have also been addressed. In France and Japan, which have been at the forefront of technopole policy, shortcomings have been identified in that the synergies expected between laboratories and companies located in close proximity to each other did not fully materialise. Consequently – also in order to make innovation work as an interactive, systemic process – more attention has started to be paid to factors that lead to companies and innovation support organisations being better embedded in the collaborative model.²²

²¹ Shearmur, Richard–Carrincazeaux, Christophe–Doloreux, David (2016): *Handbook on the Geographies of Innovation*. Publisher: Edward Elgar, UK, 481.

²² Cooke, Philip (2001): *From Technopoles to Regional Innovation Systems: The Evolution of Localised Technology Development Policy*. *Canadian Journal of Regional Science/Revue canadienne des sciences régionales*, XXIV:1 (Spring/printemps 2001), 21-40. ISSN: 0705-4580;

(Granovetter, Mark: (1985): *Economic Action and Social Structure: the Problem of Embeddedness*. *American Journal of Sociology*, 91,481-510).

CENTRAL EUROPEAN EXAMPLES TO ILLUSTRATE THE ROLE KNOWLEDGE CENTRES PLAY IN INNOVATION ECOSYSTEMS

In the following, the practical equivalents of the theoretical context will be examined, discussing examples and practices of innovation cooperation models in operation today. These models focus on knowledge centres and their role in knowledge production, knowledge sharing and regional development. Up-to-date data and information on current cooperation models were provided by the knowledge centres that participated in the present research as partners. These partner institutions and their key data are presented in Table 1 below:

Name of the institution	Profile	Headquarters
UNWE: University of National and World Economy	Higher education and scientific activities	Sofia, Bulgaria
UNESCO Chair on Intersectoral Safety for Disaster Risk Reduction and Resilience	Scientific research activities	Udine, Italy
IRMO: Institute for Development and International Relations	Research institute	Zagreb, Croatia
The Center for Advanced Researches	Research institute	Skopje, North Macedonia

Table 1: Data on the actors involved in the partnership

Source: Table compiled by iASK



UNWE (University of National and World Economy)

The University of National and World Economy (UNWE) in Sofia, the capital of Bulgaria, is positioning itself in the knowledge economy ecosystem of its region as the university soon to become a leading higher education institution in Southeast Europe, both in terms of teaching and research, in areas such as economics, management and administration. In the context of innovation ecosystems, its activities and presence in the region as a driving force for *reform and development* in higher education as well as R&D activities are notable. Naturally, these efforts do not take place in an isolated manner, without context, but in relation to and in line with the objectives set out in Bulgaria's Strategy for Higher Education Development.

The institution also assumes a socioeconomic role in its educational and scientific activities, which is defined by the following objectives:

- improving the quality of Bulgarian higher education and its compatibility with European higher education systems in order to achieve a worthy place in the European Higher Education Area (EHEA),
- developing sustainable and effective labour market relations,
- creating a dynamic match between supply of and demand for highly qualified professionals in higher education,
- stimulating scientific research and innovation for the market economy,
- modernising management systems,
- developing career development approaches and mechanisms for lecturers as well as incentivising the best lecturers,
- expanding and strengthening the lifelong learning network,
- the widespread use of various digital tools for distance education.

UNWE adapts its educational programmes to changes in the international environment and seeks to attract students from abroad, encouraging the international mobility of students and faculty by expanding as well as strengthening international cooperation with leading universities and international research institutions abroad.

UNWE is also able to contribute to knowledge creation in the region by providing annual grants for R&D activities over a period of several years (at least 2 years). Grants are awarded to professional groups, young researchers and academics. They also support the organisation of domestic and international conferences (usually 20 conferences per year). Furthermore, the university plays a role in disseminating knowledge by providing three types of grants to encourage researchers to publish scientific papers.

UNWE also plays another role in the knowledge network by serving as a venue for conferences of other actors from the academic, civil and business sectors, in which UNWE staff can also participate.

Looking at the role of UNWE in terms of how it is connected to other actors in the innovation ecosystem, the answer is that this happens through cooperation in different projects. Joint projects with other actors include international as well as operational projects. Recent joint projects at UNWE on an international scale target areas such as:

- sustainable and resilient farming systems in the EU,
- integrating talent development into innovative ecosystems in higher education,
- increasing the digital skills of adult learners,
- creating the theoretical basis for innovation and employment centres,
- building an innovative network to share best educational practices, including a game-focused approach to international logistics and transport.

The university's operational projects over the past decade have covered topics such as:

- digitalisation in the economy,
- training courses for PhD students, innovators and implementers,
- developing electronic and distance education, exploring opportunities for improving education,
- career development for lecturers,
- innovative transfer of entrepreneurial and business skills in the tourism sector.

With regards to the specific function of UNWE in the local *knowledge network*, the institution plays three key roles.

The first role is institutionalising different disciplines; areas such as *economics and political science, intellectual capital and technology transfer, entrepreneurship and postgraduate studies* are included in the organisational structures of UNWE.

The second key role is its function as a knowledge centre. Within this framework, UNWE serves as a knowledge centre for a range of knowledge-based activities and areas such as *career development, the development of student and faculty mobility, research and teaching projects* as well as hosting a *dual bachelor's degree* in management.

The third role is that of a scientific research centre, which involves hosting a number of scientific disciplines within the institution, including social sciences, natural sciences and applied sciences. The research centres build on UNWE's knowledge base and its professors, moreover, have links with the industrial sector and businesses. The general objective of the centres is to promote development in their respective fields. They also work on developing new educational programmes.

UNWE is in contact with the various regional actors on a daily basis as well as cooperates with businesses, NGOs, government agencies, ministries and other educational institutions on various issues, which is also reflected in signed agreements. UNWE is also in contact with other organisations at both the national and international levels (mainly with universities in Europe and Asia). The university's scientific relations with its partner institutions are organised on a long-term basis and considers these international cooperation projects as a top priority. For UNWE, these partnerships serve the following purposes:

- promoting student and teacher mobility,
- developing joint Master's and doctoral programmes,
- developing and participating in joint international education and research projects,
- organising and participating in joint educational and scientific events,
- exchanging information on education and research issues of mutual interest.

UNWE is an active participant in the Erasmus mobility programme within the framework of which it has concluded agreements with more than 100 European universities so far, organising annual inter-institutional exchanges of students, professors and administrative staff. UNWE is also a member of several international networks. An important question in this context is how UNWE believes that the process of knowledge sharing is currently taking place in the region, moreover, what methods and techniques can be taken into account in this regard. The institution reports that the process of knowledge sharing in Bulgaria takes on different forms, including traditional methods as well as novel digital techniques. Traditional methods include the following:

- formal education – universities, other schools and vocational training institutions disseminate knowledge through structured programmes and curricula,
- conferences and seminars – platforms for experts to share their knowledge and best practices in their respective fields,
- professional networks and associations – such groups exchange knowledge through conferences, publications and online forums.

Novel digital methods include:

- digital platforms – the use of online platforms, knowledge repositories, webinars and collaboration tools to share as well as access information is becoming more and more widespread,
- social media – the use of Facebook and LinkedIn to share knowledge and connect with experts from different backgrounds,
- international partnerships with universities, institutions and experts to increase the range of new knowledge and perspectives.

Examples of successful cooperation between UNWE and other actors also exist. These collaborations include the organisation of regular international conferences such as:

- the International Conference on the Application of Information Technology and Communication and Statistics in Economy and Education,
- the International Conference on Information Technology in Disaster Risk Reduction.

Since research institutes within the knowledge base of UNWE also participate in other international events and workshops, they are integrated into international networks, where they maintain contact with experts in the field as well as share knowledge and experience.

An important question is whether UNWE puts into practice notable innovative, creative ways of sharing knowledge that can be considered relevant to the Creative Europe programme. The response from UNWE revealed that the institution is working on the tools and possibilities of virtual reality as well as artificial intelligence, moreover, plans to use them in the future to create new audio-visual and digital content in academic subjects such as economics, tourism, design, marketing, real estate, security and IT.

Moving towards the last questions, the UNWE representative was asked to report on development projects in their region in which UNWE, as a knowledge centre, has been actively involved. He listed recent and currently ongoing projects at the Science Research Center for Disaster Risk Reduction, a knowledge centre based at UNWE's knowledge base. These projects include the following:

- Intelligent risk management for businesses concerning adverse events and natural disasters. Bulgarian National Science Fund, Grant S/N NuKP-06-H55/5 (2021-2024).
- Research on the business and educational applications of the Metaverse concept (R&D project), Grant S/N NID NI 19/2023/A (2023-2024).
- Development and use of artificial intelligence in education and the economy (R&D project), Grant S/N NID NI 1/2021 (2021-2023), UNWE.
- Research on the applicability of virtual reality in business and education (R&D project), Grant S/N NID NI 22/2017 (2017-2019), UNWE.
- Creating an information system for the integrated risk assessment of natural disasters. Bulgarian National Science Fund, Grant S/N DFNI-I02/15 (2014-2018).

These projects will focus on the exploration and development of the potential of virtual reality, artificial intelligence and the online space itself, especially in terms of new teaching methods, techniques and courses (as content).

Finally, UNWE was asked to answer the question of what traditional and creative methods/techniques it uses to share knowledge generated in the R&D ecosystem. The methods used by the insti-

tution in this regard include formal education, conferences and seminars, online publications, professional networks and associations, the use of social media as well as the building and nurturing of international partnerships.

UNESCO Chair on Intersectoral Safety for Disaster Risk Reduction and Resilience

UNESCO's Chair on Intersectoral Safety for Disaster Risk Reduction and Resilience was established in 2018 at the University of Udine, Italy.²³

The department's thematic focus is *resilience* and *disaster risk reduction with an intersectoral approach*. Their main objective is to integrate related research activities and training courses as well as available information and documentation. Their scope of activities for 2018-2024 was as follows:

- the creation and dissemination of knowledge,
- promoting synergies through international cooperation,
- developing tools and supporting expert platforms,
- close cooperation with UNESCO and other departments.

In addition to the above, the department is connected to higher education and human resources in the region in several ways. These connections are manifold—including training courses, projects, research agreements, knowledge arenas, networks of experts and decision-makers – and involve students, researchers and professionals alike. Researchers from the department also manage and organise an international school – the SERM Academy – which covers security and emergency-related topics in its training courses. This academy aims to strengthen an integrated emergency management system and improve cross-border cooperation between civil protection actors. Within the framework of the academy, the department organises courses for professional civil protection organisations and volunteers. Full-scale exercises involving local, national and international partners are also organised.

Since 2022, UNESCO organises and manages the expert platform named ResiliEnhance, which aims to develop methods and tools that can effectively strengthen regional resilience to adverse events as well as critical situations and crises. Within this platform, an interdisciplinary knowledge network has been created which integrates local, national and international institutions.

²³ The University of Udine was created in 1978 as part of a reconstruction plan for the Friuli region, following a devastating earthquake in 1976. As its inception was linked to this disaster, the University of Udine has been carrying out specific research in the field of risk assessment and disaster prevention since its foundation. This has led to the development of safety strategies that aim to reduce disaster risk to promote sustainable development and increase resilience. These strategies cover buildings, infrastructure systems, critical facilities and cultural heritage.1.

The EUREKA project, also known as a Knowledge Arena, is another noteworthy programme in the portfolio of UNESCO which focuses on intergenerational dialogue on resilience. The project aims to shape a safer and more sustainable future by not only involving professors but students and secondary school pupils as well.

The UNESCO department also organises doctoral and Master's courses at the University of Udine.

In terms of its cooperation network, UNESCO works with a number of local and international partners such as Regional Civil Protection, the Italian National Fire Brigade and the Central European Initiative. The UNESCO Chair in Udine is also an active member of the following networks:

- the Italian network of UNESCO Chairs (ReCUI),
- Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector (GADRRRES).

As for field projects at UNESCO, these address disaster risk reduction and resilience on the local and global scales. These projects grapple with the development of knowledge networks such as the *ResiliEnhance* platform mentioned above. Another practical undertaking is bringing together different actors (universities, NGOs, local actors) through the SERM Academy. They organise several events and forums to promote cooperation, interdisciplinary dialogue as well as the exchange of good practices on risk reduction and resilience.

UNESCO also works with decision-makers on disaster risk reduction at the local, national and international levels, which has practical benefits.

The steps of knowledge sharing in the region of this UNESCO Chair are the following:

- Step one is usually an initiative from local partners to set up a project, which then leads to developing its organisational structure as well as identifying and involving local stakeholders.
- Then online and offline meetings are organised to share knowledge as well as coordinate approaches and methods.
- Additional meetings are organised specifically to encourage the active involvement of participants.
- The next step is implementing the projects with the participants involved.
- The last step is sharing the results through workshops and in reports.

UNESCO's projects can be considered as good practices for successful cooperation with other actors. The SERM Academy, the VISUS projects (Safety Inspection Visits of Road Infrastructure), the *ResiliEnhance* platform and the EUREKA project can all be regarded as exemplary models of cooperation.

UNESCO also applies some remarkably creative and innovative methods as well as approaches. One such methodology is the innovative approach to intersectoral security which involves combining

technical, socioeconomic and human behavioural aspects while exploiting interdisciplinary and inter-institutional synergies in an attempt to improve cooperation between the various actors in the fields of security and resilience. In addition, researchers at UNESCO have developed a handbook providing guidelines for the rapid assessment and classification of critical situations (disasters) as well as their effective management. Vademecum STOP – an innovative decision-support tool for planning post-seismic responses developed by researchers at the Institute and used by Italian firefighters as well as civil protection personnel in the event of a disaster – should also be mentioned.

In recent years, UNESCO has also been involved in regional development projects; since 2013, the Chair has organised 11 international projects involving local experts, university professors and students. One of the key themes of these projects is improving school safety and the development of related strategies. They have also sought to enhance the integrated functioning of the emergency management system to improve cross-border cooperation and joint action between the various actors involved in disaster management and civil protection.

The department shares knowledge in the knowledge ecosystem of its region by applying methodologies such as in-person meetings, webinars, reports, knowledge arenas, meetings in cafés, teamwork and collaborations.

IRMO (Institute for Development and International Relations)

IRMO in Zagreb, the capital of Croatia, was founded in 1963 as a state research institute. Its main research interests are topics related to the social sciences, including economics, culture, political science and sociology. At the same time, the institute emphasizes the application of an interdisciplinary and transdisciplinary approach to its research by fostering connections between various disciplines. Its research projects focus on sustainable development, public policies as well as international economic, political and cultural relations. Within these, the following areas are explored:

- the community policies of the European Union,
- cultural policy, communication and media,
- regional, urban and rural policy,
- environmental policy (bioeconomy, environmental protection),
- energy and climate policy,
- economic policy (competitiveness, entrepreneurship and innovation),
- foreign policy,
- and European security and defence policy.

The institute carries out part of its applied research for government departments, agencies as well as local and regional governments. This research provides the scientific basis for the design, implementation and evaluation of public policies in many areas of economic, social and cultural life in Croatia. As a partner of international research institutions, IRMO also participates in international programmes, research projects and publishing studies. In particular, international networking at the Institute takes place via the implementation of projects funded by programmes and funds such as IPA, Interreg, Horizon 2020, Horizon Europe, Erasmus+ and the Trans-Atlantic Platform. IRMO also participates in bilateral cooperation programmes and partnerships with international organisations such as the World Bank, UNDP and UNESCO.

The mission of IRMO is the following:

Carrying out outstanding scientific and research work as well as transferring knowledge and skills in the field of international economic, political and cultural relations for the sustainable development of Croatia.

The vision of IRMO is:

IRMO aims to be a prominent European scientific research institute in the field of international relations and cooperation for sustainable development.

The primary objective of the institute is to *increase scientific productivity* and the *applicability of scientific research* by promoting research partnerships and improving the research environment for young scientists as well as increasing the participation of Croatian scientists in EU projects or other international programmes and platforms. Cooperation through workshops, study tours and conferences involving international as well as Croatian scientists and experts will create a superb opportunity for networking and sharing experiences on similar development opportunities. IRMO is also a key member of the Culturelink Network, which was established by UNESCO and the Council of Europe in 1989.

In addition, IRMO is a member of the Trans European Policy Studies Association (TEPSA), the first pan-European research network on EU affairs, which includes leading research institutions across Europe such as:

- the European Association of Development Research and Training Institutes (EADI),
- the European Regional Science Association (ERSA),
- the Croatian Association for Sustainable Development.

Researchers at IRMO are also members of various professional networks (e.g. Interpret Europe - European Association for Heritage Interpretation; European Association of Social Psychology; Croatian Fulbright Association); many of whom hold prominent positions in these organisations.

Some of these researchers are also members of the editorial boards of academic journals (e.g. The European Journal of Cultural Management and Policy, *Turyzm* (Translation: Tourism), etc.) and have won research grants from various research institutions and universities in Hungary, Slovakia, Canada and the USA among other nations.

With regards to the specific role of the institution in the development of knowledge networks, the following can be stated:

IRMO is a leading and regular partner in a number of European projects that foster knowledge cooperation networks; it organises conferences, meetings and workshops with national and international researchers as well as regularly produces the online publication “IRMO short”, which includes the publications of several researchers. Smaller meetings are also organised at their institute.

When asked how their institute can work with actors in government and strategic development, IRMO gave the following answer:

One of the key priorities of IRMO is implementing applied research and strategic planning to support decision-making for government departments, agencies as well as local and regional authorities. To date, IRMO has developed a number of development strategies for towns and counties as well as thematic development strategies (e.g. in the fields of culture, tourism, business and SME development, digitalisation, green infrastructure, etc.) targeted at the local, regional and national levels. In addition, due to its expertise in the field of culture, IRMO is nationally recognised as a top institution offering cultural policy courses. It has also been involved in the preparation of management plans for various heritage sites (including several sites registered in the national heritage databases or UNESCO World Heritage Sites). In addition, researchers at IRMO evaluate various preliminary, medium-term and long-term strategic documents. IRMO has also organised various training courses for public administration personnel.

Our questionnaire includes the following question: How would you describe the processes and steps of knowledge sharing in your region?

The following answer was given: IRMO is a well-recognised cultural policy school in Zagreb, where knowledge is shared through policy advice and the preparation of various policy and planning documents. In connection with these activities, IRMO is involved in the knowledge sharing process in its region in several ways:

- A the individual initiatives of research groups at IRMO such as the publication of a series of guidebooks (e.g. *Cultural Heritage in Practice*), which are then promoted at conferences, meetings and events (e.g. on Heritage Days),

- B by creating two training programmes to contribute to knowledge sharing:
 - a a postgraduate programme on the preparation and implementation of EU projects (currently being prepared for Montenegro as well),
 - b the doctoral programme “Business Economics and Sustainable Development”,
- C organising or participating in conferences, meetings and workshops,
- D being active members of various associations,
- E involving individual researchers in teaching at university or business schools,
- F organising various events to promote science,
- G participating in mobility programmes (internal and external mobility).

Although IRMO is very active in all aspects of knowledge sharing mentioned above, it should be noted that this does not happen in a top-down fashion but is the result of the efforts of proactive individuals who create or respond to opportunities.

It is important to list the good practices that have been developed in terms of successful cooperation with other actors:

- maintaining close links with previous project partners (e.g. researchers), leading to new collaborative projects,
- maintaining an active relationship with the decision-makers the institute has cooperated with in the past and based on the high-quality documents submitted previously, IRMO is often involved in further projects,
- participating in the Culturelink Network,
- implementing IRMO’s own stand-alone projects (funded by UNESCO’s IFCD), including the creation of a database of creative professionals (for Zagreb) to promote and develop the creative industries.

The last question posed to the institute was whether IRMO has any notable creative as well as innovative methods and approaches that fit within the concept and framework of the Creative Europe programme.

In this respect, although IRMO has not yet focused on the issues of virtual reality, innovative business tools (e.g. AI, big data, blockchains, virtual worlds, NFTs, etc.) or greener practices in knowledge sharing, some of its research and other activities have included the topics of AI and, marginally, virtual reality.

The Center for Advanced Interdisciplinary Research

The Center for Advanced Interdisciplinary Research is a thinktank in North Macedonia that aims to bring together intellectuals from all generations (including retired professors) to advance scientific thinking, especially in the social sciences and humanities. Through scientific research and debates, the Center makes relevant and useful predictions to explain contemporary phenomena. Its mission and responsibilities are to help navigate through complexity and uncertainty, contributing to the formulation of answers to questions that require more complex, interdisciplinary thinking. The leadership at the Center for Advanced Interdisciplinary Research is composed of eminent, already proven experts and professors, but also includes active members from the public sphere of North Macedonia.

The Center is also linked to the region's higher education institutions and human resources by being a founding member of the Academic Network for Cooperation in Southeast Europe (2018), which focuses on multiculturalism and the protection of the rights of national minorities. Their work is based on the conviction that science can contribute to better social relations and mutual understanding in Southeast Europe in order to build a stable and developed region.

To this end, an international conference entitled "The Ghosts and Shadows of Yugoslavia: Reflections and Processes 30 Years After the Break-up of the FRY" was organised in 2021 and held in Skopje on the 25th June 2021. Furthermore, in order to network with other members of the Academic Cooperation Association, a number of international conferences, workshops and other events – such as the annual conference in Brijuni, Croatia – are organised to exchange information, experiences and knowledge. As for networking and knowledge-sharing activities, several books and other publications have been published. For example, a complex and interdisciplinary international study entitled "Changes" will be published in 2024, analysing and exploring a broad spectrum of processes as well as phenomena in the area of the former Yugoslavia over the last three decades.

Since 2013, the Center for Advanced Interdisciplinary Research has been organising a regular annual conference, that is, the International Conference on Cultural Heritage, Tourism, and Sustainable Local Development. To date, 12 books comprising papers presented at the conference have been published. These conferences are attended by more than 500 scholars and experts from over 30 countries worldwide. The conference is held annually between 17th and 19th January in Ohrid before the celebration of Epiphany, which is another tourist attraction in this ancient town.

Over the past two years (2022 and 2023), the Center for Advanced Interdisciplinary Research has organized the Summer School for the Protection of the Rights of Communities and Multiculturalism,

which was attended by more than 40 students from different universities, faculties and institutions, providing them with additional knowledge in these fields as well as networking opportunities.

The national strategy on the concept of “One society and interculturalism” was developed between 2020 and 2022 and was the first document in North Macedonia to take into account the different divisions in society; moreover, this was the country’s first strategy on European interculturalism. The 2020-2022 strategy initiated activities to enhance communication and cooperation between communities, aiming to create a society where everyone feels like an equal member. The Center for Advanced Interdisciplinary Research as an institution and its staff as individuals have both played important roles in the development of this strategy.

Background:

According to the latest opinion from the Advisory Committee of The Council of Europe's 2022 Framework Convention for the Protection of National Minorities (FCNM), North Macedonia has made significant progress in recent years in protecting the rights of national minorities, particularly in the areas of anti-discrimination and the use of the Albanian language. However, the Advisory Committee urged "the authorities to take further steps to promote an integrated society based on respect and trust between different communities". In order to ensure the sustainability of the “One Society for All” Strategy, the authorities need to ensure a high level of political support, solid funding and access for education professionals, the media and civil society as well as the general public.

The Center’s programme “Inclusion of Marginalized Groups in the Gig Economy (MarGigIn)”, implemented in 2023, was a cross-border initiative in cooperation with a Bulgarian “Human Resources Development Center”. The project aimed at strengthening the inclusion, promotion and employment of marginalised groups through the implementation of an innovative model of career counselling and socioeconomic integration in the context of the gig economy in the border towns of Kriva Palanka (North Macedonia) and Kyustendil (Bulgaria).

MODELLING – THE STRUCTURE AND FUNCTIONING MECHANISMS OF KNOWLEDGE ECOSYSTEMS BASED ON CENTRAL EUROPEAN PRACTICES

In this section, an attempt is made to generalise the roles, functions and mechanisms that can serve as a model for the organisation and development of future knowledge networks based on the Central European practices presented above. In this context, the individual functions are highlighted that can be interpreted as the tasks and roles of knowledge centres in general. Finally, the knowledge centre institutions in their respective innovation ecosystems are situated in Figure 1, indicating the interactions and mechanisms between the various actors.

Basic research

Knowledge centres are usually established on the knowledge base of universities or as independent institutions employing researchers with PhD degrees. This results in high-quality research being carried out by individual researchers in their own fields. In this respect, the classical research function can be identified with publications and presentations delivered at conferences.

Applied research

The surveyed research centres reported that they not only conduct basic research for the academic sector but also implement research projects with practical applications for a wide range of other stakeholders (applied research). These actors – partners – can include government authorities (ministries and other bodies), local authorities (i.e. individual municipalities) and businesses among others. In some cases, this may involve commissioned research with practical results or the production of technical documentation, strategies, concepts, development documents, situation studies, etc.

Research portfolio

Although not an activity, the *research portfolio* of a knowledge centre can perform a very important function in itself. Based on the examples collected, it is clear that all the institutions have identified specialised research areas with expert researchers. This indicates that these in-

stitutions are highly competent in analysing social, environmental or economic problems within their respective fields. The research portfolio of the institutes also represents the scientific character of the respective institutions and differentiates them from other institutions. This means that a given ministry can turn to a specific institute if in need of research on a given topic.

Education & training

The partners interviewed also indicated that they carry out various educational activities too, which include organising various training courses for the representatives of a given field. A common type of educational activity is the organisation of doctoral programmes, which is of value to the academic sector. For the most part, it is research centres based on the university knowledge base that are typically involved in the organisation of university courses, for example, Master's courses.

Organisation of conferences

The organisation of conferences can be identified as a separate function, that is, as another key role. These conferences often take place on the premises provided by the knowledge centre and perform several key functions. Among other things, these conferences serve as a meeting point for the various actors in the knowledge networks; they are a networking tool in themselves. It is very important to stress that these conferences are also a means of sharing and disseminating knowledge, an opportunity for research institutions to showcase their scientific work and results. The research centres surveyed reported organising a significant number of conferences, in many cases up to 20 a year. The aim of these is also to open doors to the international academic world as well as give doctoral students and young researchers the opportunity to present the results of their research.

Grants, acquiring funding & research projects

The research centres also reported that they are capable of raising and securing funds to launch various research projects which, in some cases, can support the work of researchers for several years. Obtaining grants and successfully participating in tenders, for example, are common

methods of funding research projects. In many cases, funds are also used to incentivise the production of scientific publications. This ability to raise funds also means that these research institutions have both the human resources (grants officers) and the know-how to apply for grants, moreover, in many cases, their fundraising capacity is on the same level as that of public universities. This proactive resource mobilisation by knowledge centres also serves as a significant incentive to promote scientific research.

Partnerships with and memberships of international organisations

Most research centres are affiliated to, members of or cooperate with various international organizations, including major global entities like UNESCO. These partnerships, memberships and collaborations offer several benefits to knowledge centres. On the one hand, they boost their capacity to develop knowledge networks and extend their reach, helping them expand their networks considerably. On the other hand, these memberships also contribute to their professional prestige. Through these international partnerships, knowledge centres are encouraged to focus on mainstream research topics and global issues, perhaps leading to greater international recognition.

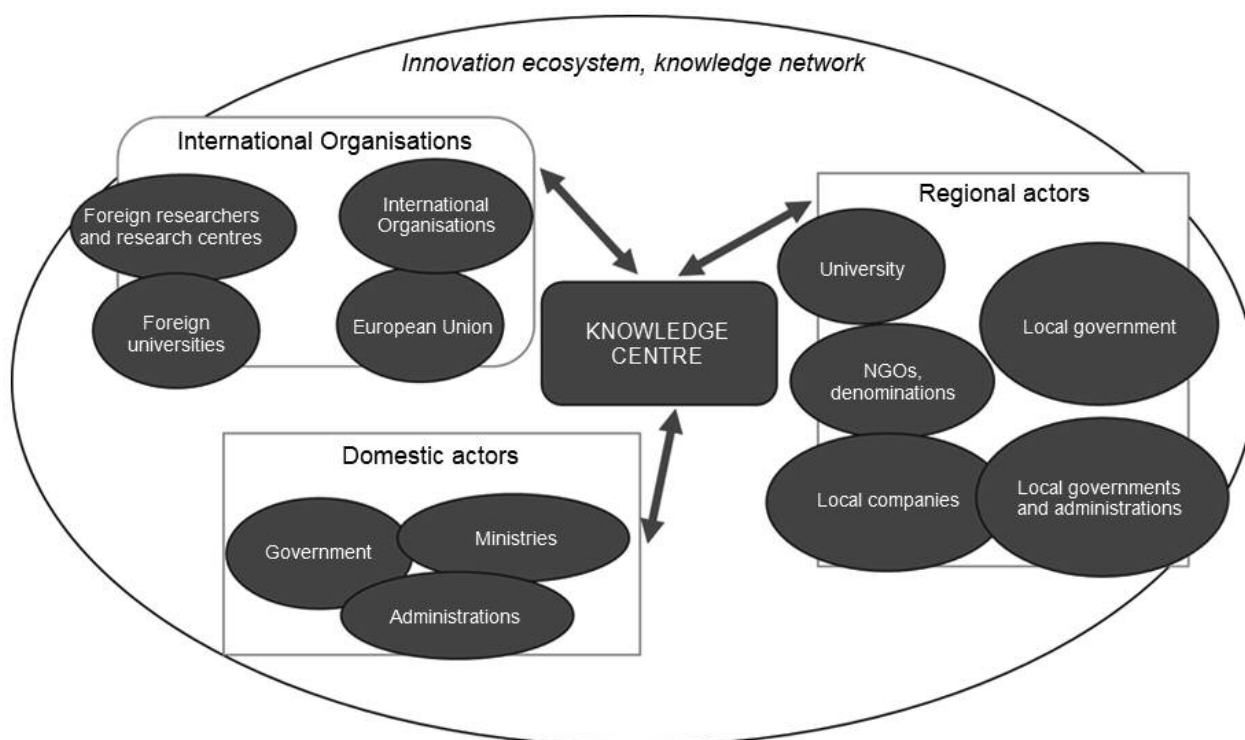
Cooperation with regional actors & assuming a central role

Several knowledge centres reported collaborating with local actors and their involvement in regional development projects. It is necessary to emphasise that in these collaborations, the given knowledge centre – and the complex regional cooperation network it participates in – focuses on the respective region, deals with local issues as well as aims at regional development with its activities and projects, i.e. localism is prioritised. In many cases, local strategies and regional development concepts are developed on a region-specific basis. In addition to providing experts and leading these efforts, knowledge centres often serve as meeting points for the projects. In these cases, the regional actors include local universities, the local government, regional development institutions, local businesses, NGOs and the knowledge centre itself.

Knowledge creation & knowledge dissemination

Finally, perhaps the most important role of knowledge centres in the innovation ecosystem, namely the creation and dissemination of knowledge, will be highlighted. Based on the reports

from the surveyed knowledge centres, it is evident that these centres – in collaboration with local economic actors as well as in response to current needs and trends – play a significant role in driving regional innovation, including the development of patents. Innovation is the knowledge-creating process that drives society forward and specific institutions such as knowledge centres can significantly contribute to inducing as well as creating innovation. However, knowledge creation in itself is not enough to achieve the desired results; knowledge centres also have a role to play in disseminating knowledge in an effective manner. The examples included in this study show a wide range of good practices, including the organisation of conferences, promotion of publications, implementation of research projects as well as organisation of various education and training programmes. After all, knowledge centres in the regional knowledge network are able to create knowledge in line with current trends and have the means to disseminate this knowledge and the resulting innovations widely.



Source: Table compiled by iASK

POSSIBLE ADAPTATION OF THE KNOWLEDGE ECOSYSTEM MODEL IN KŐSZEG - SYNERGY CAMPUS



At the beginning of January 2022, the renovation of the former MÁV Children's Home in Kőszeg started, with the aim of creating a new type of research institute, the International Synergy Campus (ISC), which will be integrated into the existing organisational structure of the Institute of Advanced Studies Kőszeg (iASK). After 8 years of success, iASK is about to implement its biggest innovation ever with the creation of the ISC. This investment will be made in a complex that showcases natural, artistic and architectural heritage by promoting the integration of different disciplines while also providing a space to retreat. Located in an urban centre on the site of the former Iron Curtain, within a previously isolated settlement untouched by socialist industrialization, the ISC will serve as both a symbolic and practical link between the West and the East.

The planned functions of the ISC

- Inter-University Platform
- International Interdisciplinary Doctoral School
- UN University

- UNESCO Department - Cultural Heritage Management and Sustainability
- University of Pannonia Kőszeg Campus, doctoral cooperation
- Széchenyi István University Kőszeg Campus, doctoral cooperation
- ELTE Bibó István College for Advanced Studies

Directions for Research and Innovation

- KRAFT Research and Regional Redevelopment
- Globalisation and Sustainability Research - Central Europe and the Balkans
- Data Science and Artificial Intelligence - CONVIVIA
- Complex Social Systems
- FlexLab - Earth System and Environmental Impacts
- FlexLab - Genome Biology Research
- FlexLab - Pollution and Climate Change
- Internal and External Knowledge Services
- Startup and Spinoff Incubation
- Garden of Arts and Sciences
- György Vukán Creative Arts Centre
- Central European Research Library
- Language School and Training Centre
- Publications Office

Project concept

The Institute will pay particular attention to ensuring that the building and the functions it houses are designed with sustainability in mind. The current war, the resulting energy crisis and rising inflation further highlight the need to design and maintain optimal operating conditions while considering environmental sustainability. Since construction has already started, the technical solutions needed to create the planned functions and the other elements of investment needed to ensure sustainable operation in the long run will have to be reviewed with the involvement of experts in various technical fields. As it stands, the renovation will be completed in 2026 at the earliest, after which the Institute will be able to start operating in the building. Accordingly, in defining the functions of the ISC, it is our goal to ensure that the Campus can function as a comprehensive, complex solution centre and knowledge provider covering all significant areas. A review of the old plans is currently underway to

ensure that sustainable energy solutions are developed as efficiently as possible and that the new functions are implemented. According to the available plans, the main building will have a single level dedicated to laboratory space (FlexLab) to support the planned research activities.

The reasons for establishing iASK-ISC and the results to be achieved

- The Campus should become an acclaimed bastion of Hungarian science and innovation that is internationally acclaimed as well as can inspire a host of new R&D partnerships.
- The multi-, inter- and transdisciplinary profile of the Campus will include the social and human sciences in addition to research and innovation activities in technical fields as well as the realm of the natural sciences. All of these areas and disciplines will be interlinked by an overarching culture and frequent collaboration.
- With the help of the KRAFT integrated development model and approach, the ISC should contribute towards the protection, utilisation as well as more effective management of cultural heritage while also serving as an important information & knowledge centre and incubator for SMEs.
- Developing and increasing the capacity of research as well as the educational and further training infrastructure to create an intellectual melting pot that bridges the gap between researchers from different fields and decision-makers.
- By extending human resources and infrastructural capacities, the ISC should be able to provide various knowledge services, thereby sharing the accumulated knowledge as well as this novel approach with social, economic and state actors in a more intensive as well as effective way.
- The scope of research projects at iASK should be extended to include more key issues as well as the methodology of community science. This should be accomplished by simultaneously providing outstanding young and senior researchers with iASK research fellowships, establishing new think tanks and increasing the proportion of internationally acclaimed researchers that are also active in higher education.
- The foundation of and research conducted at the International Interdisciplinary Doctoral School should contribute towards making Hungarian higher education more competitive internationally as well as increasingly integrated into the top educational/research networks in Europe and worldwide.

Conclusions

The status quo report presented here focuses on knowledge centres as well as their position, role and functions in the innovation ecosystem and knowledge networks based on examples from Central Europe. As a first step, a list of questions was compiled that could be used to map the main tasks of existing, operational knowledge centres, their relations with various regional actors, their role in knowledge creation and dissemination as well as their innovative methods. The resulting questionnaire was sent to knowledge centres and research institutes involved in the research in Central Europe, which were subsequently involved as partners in the research. It was considered important to ground our analysis in theory. To this end, a literature review on knowledge ecosystems, knowledge networks, innovation ecosystems and regional development based on innovation was conducted. Subsequently, the main focus of this assessment was shifted to the analysis of the responses to our questionnaire from the four international partners – knowledge centres – involved in the research.

Their practices, structures, operating mechanisms, functions, roles and innovative methods were discussed. From these reports, it became clear that knowledge institutions are playing an increasingly important role in regional development, that cooperation between regional actors is becoming more and more common in Central Europe as well as that the functioning of these knowledge networks is increasingly crucial for regional development. Based on the examples presented, an attempt was made to create a model, generalising the tasks, functions and necessary roles of knowledge centres in innovation ecosystems.

Finally, the study concluded with a presentation of a planned knowledge park/centre, which could play the same role in our region in the future as the examples mentioned from Central Europe do in their respective regions. The aim of presenting all these analyses and the subsequent conclusions was to provide a clear model describing the structural, operational and functional patterns of modern knowledge ecosystems, so that the necessary knowledge is available when designing and creating such systems.

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REPORT ON: KNOWLEDGE ECONOMY ECOSYSTEM OF BULGARIA

This study has been prepared for the “Regional re-development through capacity building and creation of a research and development ecosystem with international partners” as a preparatory material for the Creative Europe project.

Prepared by Director of Science Research Center For Disaster Risk Reduction, Department Of Informatics, University Of National And World Economy, Bulgaria expert

QUESTION 1

Introduction - Based on your experience, please describe how the knowledge economy (universities, knowledge centers, knowledge networks, collaborations, industry-university links) has developed in your region over the last 1, 2, or even 3 decades, in very general terms.

In our region (Bulgaria), the *knowledge economy* has been developing successfully in recent decades, especially after the adoption of various strategic documents.

The “*National Development Program - BULGARIA 2030*” has been adopted, the main objectives of which are in line with the 17 global sustainable development goals of the United Nations (UN) “To transform the world”.

The implementation of the strategic goals is envisaged through targeted policies and interventions grouped into five interrelated and integrated axes of development. The first axis of development is “*Innovative and intelligent Bulgaria*”. The main focus of this axis of development is increasing the competitiveness of the Bulgarian economy and transforming it into an economy based on knowledge and intelligent growth. The aspiration is to ensure quality education for everyone throughout life, increasing the role of science in the country’s economy, in parallel with providing a favorable environment for the realization of new products and markets, as well as the development of innovative enterprises and increasing the potential for creating a high-tech industrial base. Within this axis, the government defines three national priorities:

- Priority 1 “Education and Skills”;
- Priority 2 “Science and scientific infrastructure”;
- Priority 3 “Smart Industry”.

The three priorities are in line with the following global goals for sustainable development: 4th “Quality Education”; 8th “Secure work and economic growth”, 9th “Innovation and infrastructure”. The main goal of the policy in the field of science and scientific infrastructure is to stimulate and accelerate the process of development and implementation of innovations in individual economic sectors with the aim of developing the knowledge economy. In this case, the relationship between educational institutions (universities), scientific centers (knowledge centers) and business is key. The priority is to increase the quality of human capital, through the formation of highly educated, innovative and active individuals, capable of realizing themselves successfully as professionals. The focus is on stimulating applied scientific developments and measures for their commercialization and turning them into marketable products with high added value.

An important basis for the development of the knowledge economy in our region is the

developed and successfully implemented ***“Innovation Strategy for Intelligent Specialization (ISIS) of Bulgaria 2021-2027”*** (initially for the period 2014-2020). The strategy focuses on strengthening research and innovation capacity, digitalisation, the growth of small and medium-sized enterprises (SMEs) and the development of skills needed to implement smart specialisation.

It is known that high-tech (HTS) and knowledge-intensive services (KIS) include economic activities that produce products with high added value and are of increasing importance for the qualitative development of the economy.

In this regard, data for Bulgaria for the period 2010-2019 show that enterprises providing knowledge-intensive services grew by 41%, and enterprises providing high-tech services grew nearly 2 times. The data also show that 5% of the employed (working people) are engaged in providing high-tech services. The largest increase in employment was observed in the provision of high-tech services (growth by 75%), in knowledge-intensive services (growth by 33.3%), in medium-high-tech activities (growth by 22.6%), in high-tech activities (growth by 12.1%).

The data on the human capital involved in research and development (R&D) in the country show an upward trend in the period 2010-2020. The trend of people engaged in R&D in enterprises is similar, which is an expression of the need for practical cooperation between science and business. In 2020, there are 35,087 people employed in R&D in the country, of which nearly 1/2 are engaged in enterprises. What’s more, in 2020, their number grew nearly 5 times compared to 2010. This is a clear signal that businesses in the region increasingly appreciate the need to expand their cooperation with ***universities and knowledge*** centers to increase their competitiveness and offer products/services with high added value.

During the first two program periods of the country’s membership in the EU, efforts in the field of innovation and scientific research are mainly focused on improving internal organizational and inter-firm capacity through the creation of clusters, technology transfer offices (TTOs), centers of excellence (CEP) and the centers of competence (CC). 6 Centers of Excellence (CEC) and 10 Competence Centers (CC) have been established, bringing together ***universities, scientific institutes (knowledge centers) and business organizations***.

ISIS 2021-2027 defines five thematic areas in which Bulgaria has a competitive advantage and capacity for intelligent specialization and should direct its efforts to their accelerated development: *“Informatics and ICT”*; *“Mechatronics and Microelectronics”*; *“Healthy Living, Bioeconomy and Biotechnology Industry”*; *“New Technologies in the Creative and Recreational Industries”*; *“Clean technologies, circular and low-carbon economy”*. Digitization/digitalization in the context of Industry 4.0 has been included as a horizontal priority and is present in all five thematic areas of smart specialization.

ISIS acts as a basic program document for determining the entire complex of innovation financing measures in the 2021-2027 program period, allowing interested parties access to European funding for the period through the programs: *“Competitiveness and innovation in enterprises”*; *“Research, Innovation and Digitization for Smart Transformation”*; *“Human Resources Development”*; *“Education”*. The *“Education”* program finances procedures for adapting professional and higher education to the needs of the labor market and the

development of skills for jobs with high added value, as well as activities to strengthen the partnership between business, science and education.

One of the significant instruments with national funding introduced in 2018 are the developed National Science Programs. With the implementation of these programs, a technological advantage is generated in the priority sectors, the existing capacity to overcome the fragmentation of the scientific research system, the consolidation of the scientific potential, the joint use of the built infrastructure, the concentration of financial resources for solving problems that are important for society and the development of the knowledge economy.

QUESTION 2

Actors - Who are the key actors and institutions in the knowledge economy and innovation ecosystem in your region?

In Bulgaria, the leading scientific center (center of knowledge) is the Bulgarian Academy of Sciences (BAS) with its scientific institutes and central laboratories. BAS is a factor for economic and social development of the country and an active participant in the process of building a knowledge-based society and economy.

Key actors in the national innovation ecosystem are the 6 centers of excellence and the 10 competence centers, which bring together **knowledge centers (universities and research institutes) and business organizations**.

The Centers of Excellence are *“Informatics and Information and Communication Technologies”*; *“Science, informatics and technologies in the e-society”*; *“Mechatronics and clean technologies”*; *“Big Data for a Smart Society”*; *“Heritage BG”*; *“Plant systems biology and biotechnology for the transformation of fundamental scientific research into sustainable bio-based technologies in Bulgaria”*.

The Competence Centers are on *“Quantum communication, intelligent security systems and risk management”*; *“Sustainable utilization of bioresources and waste from medicinal and aromatic plants for innovative bioactive products”*; *“Technologies and systems for generation, storage and consumption of clean energy”*; *“Digitalization of the economy in a Big Data environment”*; *“Personalized Innovative Medicine”*; *“Personalized medicine, 3D and telemedicine, robotic minimally invasive surgery”*; *“Mechatronics and clean technologies MIRACle (Mechatronics, Innovation, Robotics, Automation, Clean technologies)”*; *“Intelligent mechatronic, eco- and energy-saving systems and technologies”*; *“Clean technologies for a sustainable environment - water, waste, energy for a circular economy”*; *“Fundamental, translational and clinical research in the field of infections and infectious immunology”*.

Currently, there are 52 accredited higher education institutions in the country, of which 38 are public and 14 are private. Higher education institutions in the country offer training in numerous specialties, distributed in 52 professional fields. All universities carry out research activities that are directly or indirectly related to the development of the *knowledge economy*. With decisions of the Council of Ministers from 27.10.2022, an updated list of 10 universities that are recognized as research and actively functioning as centers of knowledge is presented. The list continues to be updated annually.

An object of the National Roadmap for the research infrastructure is the National Center for High Performance and Distributed Computing, which is a member of the European infrastructures PRACE and EGI. This knowledge center is a consortium of 9 partners (5 universities and 4 BAS institutes). The Institute for Research in Computer Science and Artificial Intelligence (INSAIT) at Sofia University was established in 2021, jointly with the Swiss Federal Institute of Technology in Zurich, the Swiss Federal Polytechnic Institute in Lausanne. The institute’s long-term goal is to be a global scientific and educational leader in the field of computer science and artificial intelligence.

QUESTION 3

Characteristics of the Links between the Actors - Summarize the links between the above-mentioned actors in a few words.

The University of National and World Economy (UNWE), as a national center of knowledge, conducts scientific research in the field of economics, politics and business.

UNWE has a signed contract (from January 2022) for fundamental scientific research between UNWE and “Petascale Supercomputer Consortium - Bulgaria”. The collaboration contributes to a synergism between centers of knowledge, competence and excellence.

The university is a leading partner in the National Center of Competence “Digitalization of the Economy in a Big Data Environment”, developing a national scientific infrastructure for the development of a knowledge economy. The University through this center is part of the European High Performance Computing Framework EuroCC.

The applied scientific research carried out at UNWE is in line with some of the priority areas of the Innovation Strategy for Smart Specialization:

- Research and analysis of e-government and digital administrative services in Bulgaria;
- Digitization and internationalization of innovative Bulgarian small and medium enterprises;
- International business and sustainable practices (following the example of Bulgarian companies operating on international markets);
- Carbon taxes in the context of the European Green Deal;
- Modernization of regional development in the context of digital transformation;
- Construction of free economic zones on the territory of Bulgaria within the framework of the “One Belt, One Road” project;
- Development and use of artificial intelligence in education and the economy;
- Macroeconomic and social dimensions of the ecological transformation of the economy in the context of the European Green Pact;
- Influence of the used mobile technologies on the internal motivation and academic success of the students;
- Development and growth of the Bulgarian economy in terms of integration;
- Analysis of inter-sectoral relations between Bulgaria and the member states of the European Union through the input-output model;
- Research and development of a conceptual model for the creation of an “academic innovation-based incubator”.
- Research and development of a financial digital ecosystem model.

QUESTION 4

Main Outputs from the Knowledge Ecosystem, Outcomes - Describe the outputs of the knowledge economy activities in your region that are of particular importance, have an impact outside the region, or have economic or social value.

UNWE is actively working to develop the knowledge ecosystem on a national and international scale through the implementation of various innovation projects, such as:

- SURE-Farm - Towards Sustainable and REsilient EU FARMing systems - Building sustainable and flexible systems of agricultural production;
- DS-FARM-Digital Skills for Smart Agriculture (“Smart Agriculture Digital Skills”, DS-FARM)
- FABUSS - Family Business Successful Succession;
- INNOTAL - Integrating talent development into innovation ecosystems in higher education;
- DIGIFIND - Enhance Adult Learners Digital Skills for Furniture Industry;
- BEESE - Boosting Employability and Empowering Social Engagement through Pro Bono;
- Digital Internationalization and Financial Literacy Skills for micro entrepreneurs /KA2/-Cooperation for innovation and the exchange of good practices;
- CTPCIE - Creation of a theoretical base for practitioners of centers of innovation and employment
- EUROMOD – Microsimulation Instrument for Modeling the Effects of Accepted Measures and Policies
- CS-04 Cyber Clinic;
- BOLSTER - Bridging Organizations and Marginalized Communities for Local Sustainability transitions in Europe;
- A conceptual model for the evaluation of fast-growing companies operating in intensive operating industries, based on the methods of artificial intelligence;
- Building an innovative network for sharing of best educational practices including game approach in the area of international logistics and transport;
- CO-WORKING - Encouraging entrepreneurship by supporting promising innovative ideas by creating pre-incubation mechanisms; PROMOTING ENTREPRENEURSHIP BY SUPPORTING PROMISING INNOVATIVE IDEAS THROUGH PRE-INCUBATION MECHANISMS
- DEMINA - Innovation and Further Education in Destination Management (“Innovation and Further Education in Destination Management”)
- The European University engaged in societal change – ENGAGE.EU
- DEBD - Digitization of the Economy in an Environment of Big Data - Digitization of the Economy in an Environment of Big Data (DIGD);

- Interface of Oracle ERP system to Big Data System;
- Integration of the Big Data System with the Petascale Supercomputer in TechPark Sofia;
- Integration of data from devices located in different networks;
- EUROCC - National Competence Centers in the framework of EuroHPC;
- IIoTNET - Industrial Internet of Things VET Network;
- LinT - Literacy and numeracy training for young entrepreneurs;
- Creating a Web Based System for Internal Use;
- “Economic education in Bulgaria 2030”.

The Science Research Center for Disaster Risk Reduction (SRCDRR) has implemented/is in the process of implementing the following projects:

- Intelligent business risk management from adverse events and natural disasters. Exploring the application possibilities of the Metaverse concept in business and education.
- Development and use of artificial intelligence in education and the economy.
- Exploring the applicability of virtual reality in business and education
- Information system for integrated risk assessment of natural disasters,

These projects have a special contribution as they introduce new (audio/visual) content, such as VR (AI-enhanced) - a challenge to be mastered in the development of new educational courses and online behaviors that are important for the development of the **Knowledge Ecosystem**.

QUESTION 5

Model - Is it possible to model, i.e., generalize, the mechanisms that sustain, develop, or improve the innovation ecosystem or knowledge economy in your region? Can you model the actors, their weight, and the interactions between them?

The knowledge economy of our region is based on our university- UNWE. The UNWE различни типове центрове на знанието, representing different disciplines, based in the university's departments and the university as a whole:

1) Institutes:

- Institute of Economics and Politics;
- Institute of Intellectual Property and Technology Transfer;
- Institute of Entrepreneurship;
- Institute of Postgraduate Studies.

2) University Centers:

- Inter-University Center for Career Development;
- Center for Management of Dual Bachelor`s Degree Programme with Tianjin Foreign Studies University /TFSU/.

3) Scientific Research Centers:

- Scientific Research Center for Regional Studies
- Center for Legal Research
- Center for Institutional Change Research
- Scientific Research Center for Agrarian Business and Nature Use
- Centre for Strategic Studies in Defence and Security
- Scientific Research Center for Logistic Research and Education
- Center for Statistical Research
- University Center for Sustainable Development
- Scientific Research Center for Good Management Practices
- Center for Nuclear Security Support
- Scientific Research Center for Social Studies, Innovations and Human Resources Development
- Scientific Research Center for Market Analyses and Prognostications

- Scientific Research Center for Criminal Justice, Criminology and Forensics
- Scientific Research Center for Business Competencies Development – Innovations and Competitiveness (u2b)
- Inter-University Scientific Research Center for Roman Law Studies and Novelistic Tradition
- Center for Energy Business and Infrastructure
- University Center for Standardization, Analysis and Financial Reports Audit
- Scientific Research Marketing Center
- Monetary Research Center
- Scientific Research Center for Media Research, Audiovisual Policy and Cultural Industries
- Center for Sociological and Psychological Research
- Center for Political Science Research
- Scientific Research Center for Disaster Risk Reduction
- Regional Center for Migration and Refugees Research
- Scientific Research Center for Real Estate Property and Urban Planning
- Center for Tourism Consulting and Project Management
- Center for Balkan Studies
- Europe-China Scientific Research Center
- Scientific Research Center for Trade
- Global Center for Sustainable Tourism and Crisis Management
- Center for Research and Development of Economic Theory
- Center for Advanced Leadership.

Those centers are built on the knowledge and experience of UNWE's professors, together with professionals from industry and business, to improve the development of the knowledge economy in all the described research areas. They operate on the basis of conducting research on new trends and developments in science, theory and practice.

QUESTION 6

Conclusion, Vision - Based on the results so far, how do you see the direction and trajectory of the knowledge economy and innovation ecosystem in your region? What is your vision for the future of knowledge, innovation, and technology in your region or even in the country? Are there concrete development plans or visions?

UNWE today is a significant knowledge center in the region, a leader in the education market, a leader in innovation in the education system, the first green university, the number 1 university in digitization, as well as a university that is proud of the realization of its graduates.

The strategic management vision of our university is to develop it as a benchmark for innovative educational, research and employer practices, as well as proactive behavior and presence in the global market of educational services, directly related to the development of the knowledge economy of our region.

At UNWE, work is carried out on two permanent priority scientific research directions:

- Research to confirm the leadership positions of UNSS among business universities in Europe;
- Economic, political, social and legal research in support of the state and business in Bulgaria.

The main goal of UNWE is to continue to develop as a significant scientific and educational center, which is a strategic partner and a worthy competitor within the European research space and innovation ecosystem. This objective is achieved through the achievement of the following four strategic objectives:

- 1 Improvement of the institutional ecosystem for the development of scientific research activity: improvement of internal institutional regulations, further electronicization in the field of scientific research activity, introduction of a system for the prevention and control of academic plagiarism, development of modern scientific infrastructure, expansion of cooperation with others higher schools and scientific organizations in the country and wide acceptance of the principles of open science.
- 2 Stimulation of scientific research activity: improvement of the criteria for scientific results, creation of a mechanism for tying the remuneration system to the achieved scientific results, improvement of the procedures for the implementation of university research projects, activation of participation in research projects with national funding, development of the training in the ONS “doctor” and activation of scientific research activity at the level of main units and scientific research centers.
- 3 Expanding the participation of UNSS in the European research area and international scientific cooperation: development of the European university ENGAGE.EU by participating in the development of a common strategy for research and innovation activity, as well as

action plans in the following areas: international relations and funding of the university network; innovative entrepreneurial models; Human Resources Development; data management and open science; effective communications. Increasing the mobility of PhD students and researchers, inclusion and participation in international scientific networks and research projects, and attracting more foreign PhD students and researchers.

- 4 Creating an effective link “education - science - business” and promoting innovation based on scientific results:
 - 4.1. Activation of partnerships with business, the state and civil society in the field of scientific research: Attracting representatives of business, the public sector and civil society to jointly build educational and scientific infrastructure and/or to jointly develop and implement scientific research projects; Participation of representatives of business, the public sector and civil society in the scientific forums organized by UNWE; Creation and active work of advisory councils to university and research centers with the participation of prominent representatives of business, the public sector and civil society; Development and adoption of an updated policy on the intellectual property of UNWE.
 - 4.2. Provision of consulting services and participation in public policies and programs: Development of regulations regulating the procedures and rules for receiving, processing and responding to official inquiries from business, the public sector and civil society, regarding the provision of consulting services by the UNWE; Active participation of UNWE and the university collegium in the development, monitoring and evaluation of public policies and programs; Creation and implementation of a communication policy on the dissemination of information in the public space about the scientific interests and professional (consulting) experience of the teachers/researchers of UNWE; Creation of a single digital portfolio for each teacher/researcher of UNWE, containing scientific interests and professional (consulting) experience.

It is planned to create a university center for the development and use of artificial intelligence in education.

Continuing work on the “Smart Home” system, building new capacities for renewable sources and turning UNWE into a green university.

The UNWE is working on building a new knowledge management system, which includes organizational mechanisms (reports, seminars, exchange of experience, etc.) for sharing, storing and upgrading knowledge, including their unification, with which to supports the development of the knowledge economy in the region.

**REPORT ON:
KNOWLEDGE ECONOMY ECOSYSTEM OF THE FRIULI
VENEZIA GIULIA REGION (ITALY)
WITH A FOCUS ON THE UNIVERSITY OF UDINE**

This study has been prepared for the “Regional re-development through capacity building and creation of a research and development ecosystem with international partners” as a preparatory material for the Creative Europe project.

This report has been jointly finalized by the UNESCO Chair on Intersectoral Safety for Disaster risk reduction and Resilience of the University of Udine (Polytechnic Department of Engineering and Architecture) and the University Central Office for Research (Area Servizi per la ricerca - ARIC).



Organizzazione
delle Nazioni Unite
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- Cattedra UNESCO in
- Sicurezza Intersectoriale per la Riduzione
- dei rischi di disastro e la Resilienza
- SPRINT-Lab, Università degli Studi di Udine
-



UNESCO Chair on Intersectoral Safety for
Disaster Risk Reduction and Resilience
Udine, Italy

Preface

This report provides an overview of the knowledge economy ecosystem of the Friuli Venezia Giulia region (Northeast Italy). Its primary objective is to provide a status quo analysis of the current regional forms of networked research and development, shortcomings and improvement opportunities on the topic of “Regional re-development through capacity building and creation of a research and development ecosystem with international partners” for the Creative Europe project.

The report addresses specific questions aimed at outlining the origin and current state of this ecosystem, particularly emphasizing the University of Udine’s role within it. The document is organized around six key questions designed to offer a concise introduction, detailing the context and the features of the knowledge ecosystem. It includes: the description on the involved actors and their respective roles, the interconnections among these actors, the primary outcomes, the operational model, and ultimately, the overarching vision.

Q1 – Introduction.

Based on your experience, please describe how the knowledge economy (universities, knowledge centers, knowledge networks, collaborations, industry-university links) has developed in your region over the last 1, 2, or even 3 decades, in very general terms.

The university system in the Friuli Venezia Giulia (FVG) region began to develop in the 20th century, with notable growth occurring particularly in the 1970s.

The University of Trieste, initially founded in 1877 as the High School of Commerce to support the growing merchant sector, evolved over time. By 1924, it had become the University of Economic and Commercial Studies, adding faculties in Law (1938), Engineering (1942), Literature and Philosophy (1943), and Mathematics, Physics, and Natural Sciences (1946).

The knowledge economy in the region received a significant boost from two main occurrences:

- the Treaty of Osimo (1975), which aimed to promote economic cooperation between Italy and the Socialist Federal Republic of Yugoslavia, including the development of scientific knowledge and technology transfer;
- the devastating 1976 earthquake in Friuli.

The University of Udine and the International School for Advanced Studies were established in 1978 as part of the strategies of recovery after the Friuli earthquake.

University of Udine was the only case, in Italy, of University founded through popular initiative, following a petition after the 1976 earthquake. According to its Statute, the University of Udine aims to “...promote the development and advancement of culture and sciences through research, education, and scientific and cultural cooperation with Italian and foreign institutions, thereby contributing to the civil, social, and economic development of Friuli”. Its commitment to local development is proved by various public engagement and technology transfer activities.

The International School for Advanced Studies (SISSA) initially focused on advanced research in physical and mathematical sciences and has since expanded into neuroscience, natural sciences, and humanities.

In 1978, AREA Science Park was established in Trieste as a national research entity and a hub for academicindustry collaboration.

In the following decades, other innovation centers were set up in the region, such as Friuli Innovazione (now TEC4I – Friuli Innovazione), Polo Tecnologico di Pordenone (now Polo Tecnologico Alto Adriatico “Andrea Galvani”), and Agemont (now also part of TEC4I - Friuli Innovazione as Carnia Industrial Park).

The FVG region has also attracted significant international institutions, including the Abdus Salam International Centre for Theoretical Physics (ICTP), the United Nations Industrial Development Organization (UNIDO), and the International Centre for Genetic Engineering and Biotechnology (ICGEB). Additionally, national institutions like some departments of the National Research Council have further enriched the scientific landscape.

In 2016, an agreement among the Italian Ministry of Foreign Affairs and International Cooperation (MAECI), the Italian Ministry of University and Research (MUR), and the Autonomous Region FVG established the Scientific and Innovation System of FVG (SiS FVG).

SiS FVG aims to foster innovation and research by connecting universities and research centers to:

- Facilitate and promote international collaboration: SiS FVG creates a “Scientific Network of Excellence” that enhances attractiveness and competitiveness of the FVG region at the national and international level
- Enhance activities that help valorisation of innovation, scientific and technology research
- Promote internationalization support services for research centres
- Technical and scientific divulgation and dissemination of innovation
- Offer training enhancing skills and expertise through specialized programs
- Provide infrastructure supplying advanced technology and laboratory facilities.

SiS FVG is aimed at enhancing the national and international visibility of regional scientific and innovation system through the technical and scientific divulgation, knowledge transfer and dissemination of innovation.

It creates a stimulating environment for research and competitiveness in the FVG region, promoting initiatives to strengthen the international scientific network. Notable recent events include “Euroscience Forum - ESOF 2020,” “Meet in Italy for Life Science 2023,” and the upcoming “Big Science Business Forum 2024.”

Despite a general decline in industrial production and exports at the national level, the FVG region experienced only a slight decrease in 2023 (-0.1%), following significant growth in 2021-2022 (+2%). Dependent employment decreased (-0.7%), while independent employment increased

(+2.3%). The decrease was mainly among males (-0.6%), while female employment rose (+0.5%). Women's labor market participation increased (+2.4%) over the three years (2021-2023), consistent with declines in industry (-4%) and construction (-1.3%), sectors dominated by adult males. The number of unemployed decreased (-14.8%), continuing the strong reduction from 2021-2022 (-19.3%), while the number of inactive individuals increased (+0.6%) in 2023.

Within SiS FVG, the University of Udine is the only university with the "HR Strategy for Researchers" label, awarded by the European Commission in May 2016 and reaffirmed in 2023. This label supports the implementation of the "European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers" (C&C), aiming to enhance human resources management and make research careers more attractive within a dynamic European research community.

In 2018, at the University of Udine, the UNESCO Chair on Intersectoral Safety for Disaster Risk Reduction and Resilience was established (the only UNESCO Chair within the SiS System). The UNESCO Chair aims to enhance disaster risk reduction and resilience through training, knowledge creation and transfer, cooperation and knowledge sharing between partners, and development of digital platforms and resources for knowledge sharing, data collection, and content dissemination.

The UNESCO Chair at the University of Udine plays a crucial role in facilitating a reciprocal exchange of knowledge between academia and the local stakeholders, including the industrial sector and public administrators. By translating cutting-edge research into practical applications, the Chair helps industries and policymakers in implementing effective disaster risk reduction and resilience strengthening strategies. Conversely, insights and feedback from these stakeholders inform academic research, ensuring its relevance and impact. This dynamic, bidirectional interaction enhances both community resilience and sustainable development, fostering a collaborative approach to addressing real-world challenges.

This overall picture underlines how the knowledge ecosystem of the FVG region has developed, creating a strong and virtuous interconnection with the economic system and, more broadly, with the territory at different scales, thereby playing a role as a catalyst for knowledge.

Q2 – Actors.

Who are the key actors and institutions in the knowledge economy and innovation ecosystem in your region?

The key actors in the knowledge economy and innovation ecosystem in the FVG region include research institutions, companies, and policymakers.

Research Institutions

The main research institutions in the FVG region's knowledge economy and innovation ecosystem are:

Universities: University of Trieste, University of Udine (UNIUD), International School for Advanced Studies (SISSA).

Conservatories: Music Conservatory of Trieste "Giuseppe Tartini", Music Conservatory of Udine "Jacopo Tomadini".

National Research Institutions: AREA Science Park, Elettra - Sincrotrone S.C.p.A., National Institute of Oceanography and Experimental Geophysics (OGS), the regional section of the Italian National Research Council (CNR), National Institute for Astrophysics (INAF) – Trieste section, National Institute of Nuclear Physics (INFN) – Trieste section.

International Research Institutes: International Centre for Genetic Engineering and Biotechnology (ICGEB), Abdus Salam International Centre for Theoretical Physics (ICTP), The Academy of Sciences for the Developing World (TWAS), InterAcademy Partnership (IAP).

Additionally, the FVG region hosts two *science and technology parks*:

TEC4I - Friuli Innovazione; Polo Tecnologico Alto Adriatico "Andrea Galvani"

Industry Sector

In the FVG region, small and medium-sized enterprises (SMEs) are predominant, but there are also some large companies, including: Fincantieri S.p.A.; Danieli & C. Officine Meccaniche S.p.A.; Acciaierie Bertoli Safau – ABS S.p.A.; Pittini Group; A2A Energia S.p.A.

The most important industrial sectors are: Naval, Design, Manufacturing, Health, Agrifood, Energy.

Policymakers

The Autonomous Region FVG has delegated specific entities to monitor regional stakeholders' interests in key economic sectors. These entities are:

"Maritime Technology Cluster FVG Scarl" for the naval sector;

"Legno Arredo Casa FVG/FVG Wood, Furniture and Home System Cluster" for the design sector;

"COMET - Cluster della Metalmeccanica FVG" for the manufacturing sector;

"Polo Tecnologico Alto Adriatico Andrea Galvani" for the health sector;

"Agrifood FVG - Parco Agroalimentare FVG" for the agrifood sector;

"APE FVG – Agenzia regionale per l'Energia del Friuli Venezia Giulia" for the energy sector.

Q3 - Characteristics of the links between the Actors.

Summarize the links between the above-mentioned actors. The links between actors are both intra- and inter-sectoral.

As regards with the intra-sectoral links, **SiS FVG acts as Regional Science and Technology Hub** and aims to create a scientific and innovation system by coordinating scientific activities, promoting the network between scientific institutions, and ensuring the territory benefits from research results for socio-economic development.

Key initiatives of SiS FVG include a partnership with the Joint Research Centre (JRC) of the European Commission and an agreement with the Massachusetts Institute of Technology (MIT) to promote collaboration, research mobility, and joint activities. Additionally, the SiS FVG's involvement in the European Programme "Active Assisted Living" supports research and development initiatives in healthy aging technology and innovation, with the Autonomous Region FVG being the only Italian region formally adhering to the Programme.

Moreover, SiS FVG plays a crucial role in developing and strengthening the regional research infrastructure, focusing on key investment areas such as high-performance computing, advanced mechatronics, and molecular biomedicine.

In parallel, companies' connections are facilitated through associations like Confindustria FVG and Confartigianato Imprese FVG, which advocate for the pivotal role of companies in economic, social, and civil progress, ensuring various, efficient, and modern services. Consumer interests are represented by organizations like Federconsumatori FVG and ADICONSUM FVG.

The intersectoral links among the key actors are coordinated by the entities delegated by the Autonomous Region FVG (see Question 2). Their own focus centers around **specialization strategy areas** (S3 – smart specialization strategy and S4 – sustainable smart specialization strategy) chosen in alignment with European Commission policies. Stakeholders, including academia, industry, policymakers, and citizens, collaborate within these areas following a quadruple innovation helix approach. **As a whole the thematic roundtables on these areas compose the Regional Innovation Hub.**

The smart specialization strategy (S3) areas for the FVG region were chosen in 2014, and comprise: agrifood, blue growth, health, design & creativity & made in Italy, and smart manufacturing (including metal industry and home system).

Key S4 areas, selected in 2021, include energy transition, sustainable manufacturing, sustainable waterborne mobility, health, agrifood, bioeconomy, and cultural heritage. Stakeholders engage in ongoing discussions within each S4 area to monitor evolving topics and adjust activities accordingly. The entities delegated by the Autonomous Region FVG oversee this coordination process.

The adoption of S4 is crucial for accessing funds from the European Regional Development Fund (ERDF) and other programs. The "Regional Innovation Hub" in FVG, focusing on "Cultural heritage & design & creativity industry & tourism," supports territorial development through managing certifications, promoting sustainable business development, assisting in project funding, data traceability, and supporting networks for projects.

These hubs operate within both global-local and local-global contexts and visions. They foster collaboration between academia, industry, policymakers, and civil society, facilitating participation in research projects on topics of common interest, continuously updated through open discussions. The University of Udine is engaged in both intra- and inter-sectoral links to make a significant contribution to the socio-economic development of the regional hubs.

Additionally, four **innovation platforms** have been established in FVG region, focusing on digital technology training for the furniture sector (“Technologies for furniture– Brugnera”), education and training in upholstery (“Upholstered Furniture – Udine”), sustainable practices in the furniture sector (“Ecodesign and Sustainability – Manzano”), and advanced technologies for wood sector training projects (“Living in Wood – Udine”).

The **University of Udine** is actively involved in this knowledge ecosystem, contributing to industrial research and innovation in the region.

Key activities and partnerships are:

- *Laboratories at UNIUD Lab Village*: the University of Udine promotes collaboration between academia and industry, offering shared technological laboratories for research in various fields like mechatronics, robotics, artificial intelligence, and more. Lab Village hosts several labs such as Lab LAMA, Linea Lab, IOT Lab, LATE Lab, AI2S Lab, SMACT 3 Lab, LATERIS Lab, PROMAS Lab, and LABAS Lab.
- *Punto Impresa Initiative*: the University of Udine has launched the “Punto Impresa” initiative to foster collaboration between academia and industry. It aims to address specific industrial challenges through tailor-made research projects, educational support, and facilitating company-university partnerships.
- *SMACT Competence Center*: this center supports businesses in digital transformation through innovation. It provides resources such as laboratories, staff, and networking opportunities. The center focuses on areas like AI, manufacturing 4.0, energy transition, and cybersecurity.
- *IP4FVG EDIH*: the University of Udine is a partner in the European Digital Innovation Hub of the FVG region, supporting regional companies in their digital transition by offering infrastructure and expertise in various technologies.
- *iNEST Project*: the University of Udine participates in the iNEST project, focusing on green and digital transition for advanced manufacturing technology. iNEST aims to foster collaboration among universities, research institutions, and companies in specific technology areas aligned with regional missions.
- *Future Farming Initiative*: the University of Udine is involved in the “Future Farming - Innovation Technology Infrastructure” project, which aims to provide advanced technology infrastructure for sustainable agriculture, focusing on foodtech, biomaterials, and biopharmaceutics.

- *Agritech Project*: the University of Udine collaborates on the AGRITECH project, which aims to enhance sustainable agriculture by providing multidisciplinary expertise and Key Enabling Technologies for increased productivity and ecological transition.
- *NBFC Project*: the University of Udine partners with the National Biodiversity Future Center project, which focuses on monitoring, conserving, and valorizing Italian and Mediterranean biodiversity across various environments.

Focus on Creativity

Within the iNEST project, the University of Udine is involved in Spoke 4, focusing on City, Architecture, and Sustainable design. This initiative aims to develop strategies for the care and maintenance of the built environment in the North-East Italy region.

The UNESCO Chair on Intersectoral Safety for Disaster risk reduction and Resilience leads an international platform in the Central European area for enhancing resilience to disasters creating a knowledge bridge between science and policymakers. Using creativity within a global vision, it contributes support to sustainable development in the context of the Central Europe Initiative for a resilient development, aligning with the more recent UN strategies considering the three main components: planet, people, and prosperity.

These initiatives highlight the University of Udine commitment to research, innovation, and collaboration aimed at addressing various societal and environmental challenges.

Q4 - Main Outputs from the Knowledge Ecosystem, Outcomes.

Describe the outputs of the knowledge economy activities in your region that are of particular importance, have an impact outside the region, or have economic or social value.

The knowledge ecosystem in the FVG region primarily generates calls for proposals for regional beneficiaries to execute research and innovation initiatives, leading to funded research projects. European funds tied to the European Commission's Cohesion Policy, including ERDF, European Social Fund (ESF), and European Agricultural Fund for Rural Development (EAFRD), play a pivotal role. ERDF supports industrial research through regional operational programs and Interreg programs, while EAFRD aids in regional rural development. Under the regional operative programme ERDF, 2,860 projects were funded between 2014-2020, with new initiatives for 2021-2027 underway. The FVG region participates in three cross-border Interreg programs: Italy-Croatia, Italy-Slovenia, and Italy-Austria, funding a total of 517 projects since 2014. Transnational Interreg programs like EURO MED, Central Europe, ADRION, Alpine Space, and Europe also contribute significantly.

ESF supports educational initiatives, including programs for young researchers, while EAFRD funds the primary sector, both directly boosting regional innovation. The Autonomous Region FVG allocates internal resources through regional laws to support various areas like health, translational research, agriculture innovation, and cultural heritage.

The SiS FVG initiatives play a crucial role in cultivating a vibrant scientific environment by coordinating key efforts among regional research institutions. Notably, resources have been provided for fellowships for regional researchers and collaborations with the JRC and MIT researchers. It also supports research infrastructures of European, national, and regional significance, facilitating advanced research and innovation in the FVG region.

The regional knowledge ecosystem has significantly contributed to boost the research opportunities at the international level.

Concerning the R&I Framework Programmes of the European Commission (i.e. Horizon 2020 and Horizon Europe), since 2014 the participations of regional beneficiaries in EU projects are 677. The beneficiaries include universities, research infrastructures, national and international scientific institutions, innovation centres, companies (large companies and SMEs), and administrations. The total EU net contribution is 197 M€ approximately, aimed to co-finance investments of more than 261 M€.

The University of Udine is actively engaged with the regional knowledge ecosystem, benefiting in various ways. Educationally, the university hosts around 14,800 students annually, with an average of 3,019 graduates per year (2019-2022) and an employment rate of 79.2%, surpassing the national average of 75.4%. This active involvement aids in creating professional profiles that contribute to regional and national socio-economic development.

In terms of research, from 2014 to 2024, the University of Udine has undertaken 493 projects funded at regional, national, and international levels, facilitated by collaborations within the knowledge ecosystem. Notable projects include those funded by regional programs like ERDF and EAFRD, Interreg programs, national programs, EU programs, and international initiatives, resulting in significant impacts both regionally and beyond.

The research efforts of the University of Udine have led to the creation of 47 spin-offs and start-ups, with 11 active spin-offs currently affiliated with the university. These ventures have made strides in technological transfer, with 60 active patents registered and approved at national and European offices in 2023, of which 42 are licensed or assigned.

Moreover, the university's departments are actively engaged in public outreach, with monitored activities increasing from 423 in 2020 to 1,120 in 2023. Various communication events like "Conoscenza in festa," "Botteghe del sapere," and others have been organized to engage citizens of Udine and the FVG region.

In line with the Citizen Science principle, University of Udine initiated the "Cantiere Friuli" project, focusing on citizen-centric projects within the FVG region. Projects under this initiative include "Futuro del Friuli," "Prize Cantiere Friuli," "Covid-19 response," and "Universitudine," aimed at enhancing the quality of life for Udine's residents through collaborative efforts between the university and the local community. Additionally, a YouTube channel named "Play UNIUD" was launched in 2020 to broadcast these communication events online.

Q5 – Model.

Is it possible to model, i.e., generalize, the mechanisms that sustain, develop, or improve the innovation ecosystem or knowledge economy in your region? Can you model the actors, their weight, and the interactions between them?

The knowledge ecosystem of the FVG region can be described as a model organized on two levels of elaboration (exploration and synthesis/visioning) which serve as the basis for defining regional research and innovation policies and strategic activities exploiting the contribution of the SiS FVG research and innovation ecosystem.

The first level focuses on exploring the evolution of different thematic areas from different perspectives. This is achieved through the participation of various groups of actors and stakeholders within the system, each representing a specific profile, in alignment with the quadruple helix approach (i.e. science and technology institutions, policy makers, companies, consumers):

- Group “Science and technology”: Based on the SiS FVG, typically includes universities and research entities located in the region. A coordinator for this group may be designated, such as the “Regional Science and Technology Hub” in the FVG region.
- Group “Local authority”: May correspond to the regional administration or encompass other local authorities, depending on the specific expertise required.
- Group “Market”: Encompasses manufacturing and service companies, with coordination potentially managed by a representative association.
- Group “Consumers”: Represents the interests and perspectives of consumers.

At this level, each group discusses the evolution processes within their specific thematic areas, drawing upon their unique viewpoints.

Coordinators (if any) or representatives gather data and opinions from their respective group members (i.e. science and technology institutions, policy makers, companies, consumers) to inform the broader understanding of the topic. Each actor profile contributes their vision, aligning with one of the four helixes of the proposed approach. In each group, the coordinator/representative may organize updating and networking initiatives and events to increase the knowledge and awareness of participants.

The second level aggregates the representatives of the first level’s entities to enlarge the discussion to include the different perspectives and achieve a global vision at the regional level. The second level requires a coordinator, which in the FVG region corresponds to the “Regional Innovation Hub”.

At the second level the different points of view are integrated to set up a common and multifocal vision to address the evolution process in the specific area at both the regional and the national levels, if applicable.

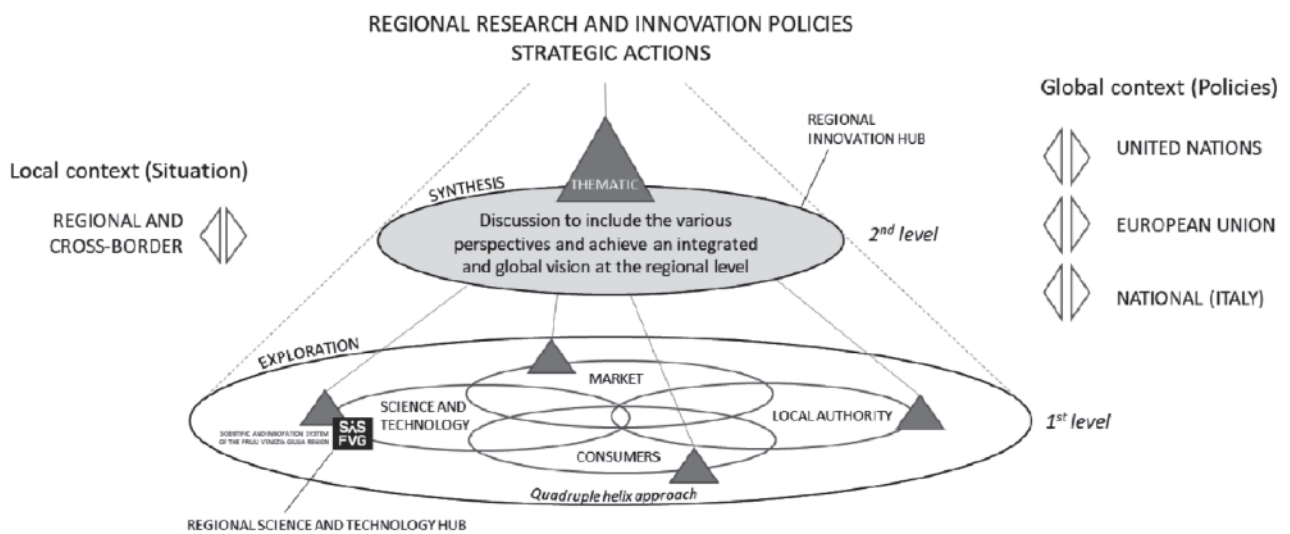
The regional funding schemes may benefit from the implementation of this model, acknowledging in the programs and in the related calls for proposals the indications about the requirements for the most relevant areas of interest by the regional stakeholders. In fact, the model ensures that the in-

dications are representative of the regional territory, taking into consideration the visions of all actor profiles. The consistency between demand and supply of innovation represents the starting point to boost the socio-economic development of the regional territory.

Taking into account the outcome of this process, based on a systematic and strong involvement of local stakeholders, the Autonomous Region FVG defines regional research policies and strategic activities also at the international level.

The following figure schematizes the model.

FVG REGIONAL RESEARCH AND INNOVATION ECOSYSTEM



Q6 - Conclusion, Vision.

Based on the results so far, how do you see the direction and trajectory of the knowledge economy and innovation ecosystem in your region? What is your vision for the future of knowledge, innovation, and technology in your region or even in the country? Are there concrete development plans or visions?

The knowledge economy and innovation ecosystem of the FVG region is strictly related to the Global Agendas, EU and National strategies of research and innovation. This vision received a particular impulse after the COVID-19 pandemic. In particular, to address the challenges and to promote the country's economic and social recovery, the Italian government introduced the National Recovery and Resilience Plan (NRRP) as a strategic program also for research and innovation.

The operative programme ERDF 2021-2027 adopted by the Autonomous Region FVG acknowledges the NRRP and defines two main challenges: to boost competitiveness of the economic system through innovation and digital transition and to enforce the socio-economic development mainly in the urban and marginal areas. The main weaknesses to overcome regard a certain gap in product innovation, in collaboration among companies and research institutions, and in homogeneity of the territory.

This programme is connected to the ESF and EAFRD ones concerning the social innovation and development mountain territories. Furthermore it cooperates with the cross-boarder Interreg programmes and specifically in the framework of the Interreg Italia-Austria programme, which includes the main mountain areas of the FVG region.

The challenges identified in the Cohesion Policy's tools are able to contribute to achieve some UN goals: 1 (No poverty), 8 (Decent work and economic growth), 10 (Reduce inequalities), 11 (Smart cities and communities), 16 (Peace, justice and strong institutions), and 17 (Partnership for the goals).

In the sector of university education and research, the NRRP aims to enhance higher education and scientific research through targeted investments. These include: modernizing university infrastructure, implementing innovative technologies to improve the quality of teaching and research, strengthening online education, and promoting international mobility for students and researchers.

The Italian Ministry of University and Research (MUR) has introduced measures aimed at promoting partnerships extended to research ecosystems to enhance collaboration between universities and research sector stakeholders. These measures seek to foster the creation of broader and more inclusive collaborative networks, involving not only academic institutions but also research centers, businesses, and other entities in the research and innovation domain.

To incentivize these extended partnerships, the MUR has implemented specific programs and funding to support shared research projects between universities and other research and innovation system actors. These initiatives may involve collaborations for developing interdisciplinary research projects, knowledge and skill exchanges, and joint efforts to promote innovation and technology transfer.

Furthermore, the MUR encourages active participation of universities and other research system actors in local and national innovation ecosystems, fostering the creation of synergies and leveraging the skills and resources present in the Country. These measures aim to strengthen the research and innovation capacity of the Italian university system and promote the development of innovative and competitive solutions in the global context.

Moreover, the NRRP aims to foster collaboration between universities, research centers, and businesses to promote knowledge transfer and the development of concrete and sustainable research projects. This integrated approach seeks to strengthen the Italian university system, make it more competitive internationally, and foster economic growth and innovation in the country.

The NRRP MUR (National Recovery and Resilience Plan of the MUR) provides guidelines for initiatives in the Education and Research sector. In particular, the component “4.2” of the NRRP MUR focuses on the aspect “from research to business”. The main objective of this component is to promote the transfer of knowledge and technologies from the research sector to the business sector. This includes encouraging the creation of university spin-offs, facilitating collaboration between universities and businesses for the development of innovation projects, and promoting the valorization and commercialization of research results. The aim is to stimulate the creation of a more dynamic and collaborative ecosystem between research and businesses, promoting economic growth and innovation in the Italian landscape.

The component 4.2 aligns with several goals of the UN 2030 Agenda. For example, fostering collaboration between universities and businesses to promote innovation and technological development contributes to Goal 9 (Industry, Innovation, and Infrastructure) and Goal 4 (Quality Education). Furthermore, by promoting economic growth and stimulating the entrepreneurial ecosystem through technology transfer, the NRRP MUR contributes also to Goal 8 (Decent Work and Economic Growth) and Goal 17 (Partnerships for the Goals).

In essence, the connection between the NRRP MUR and the UN 2030 Agenda underscores Italy’s commitment to promoting sustainable development, innovation, and economic growth in line with the global goals set by the United Nations.

The Regional Science and Technology Hub (i.e. SiS FVG) and the Regional Innovation Hub work within this context and operates adopting the sustainable development strategies of the Next Generation EU and the other EU strategies for facing the challenges for a future-based sustainability, prosperity, and wellbeing, where innovation and creativity are catalysts of a better and more resilient future.

Within this framework, the University of Udine has defined its Strategic Plan 2022-2025, which is the programming document that outlines the mission, strategic directions, and objectives of the university in the coming years. The Plan identifies three programmatic lines of action: teaching, research, and organization. The Plan, named “Deciding for the Future” allocates resources totaling 30 million euros, for:

- implementing the strategic plans designed by individual Departments concerning teaching, interdepartmental research projects, and departmental research projects;

- developing University actions focused on increasing doctoral scholarships and enhancing teaching and student services;
- implementing the university building projects (new constructions, renovations, and expansions of existing buildings) co-financed by the MUR;
- financing of energy efficiency interventions on university buildings.

The Plan is structured around nine strategic objectives that align with the University's overall vision. This vision emphasizes the importance of characterizing the educational and scientific profile through an interdisciplinary and international approach while preserving the unique identity of a university founded by popular will and deeply rooted in the territory. These strategic objectives are:

- Progressive characterization of research activities and educational offerings.
- Strengthening distinctive and qualifying research and teaching sectors and overseeing interdisciplinary areas.
- Integration of research and teaching on an international scale.
- Promotion of generational balance between teaching and research staff.
- Reduction of students' dropout rate.
- Enhancement of the third mission: University as a development agent for the territory.
- Development and improvement of university buildings.
- Strengthening support for technical and administrative staff in teaching and research activities.
- Medium-term economic and financial sustainability.

The strategic plan of the University of Udine is deeply based on the UN goals.

The transversal actions are able to contribute to the following goals:

- 4 (Quality of education),
- 5 (Gender quality, specifically due to adoption of the Gender Equality Plan),
- 7 (Affordable and clean energy, thanks to the investments in energy efficiency),
- 8 and 10 (Decent work and economic growth and Reduce inequalities, due to the C&C and HR Strategy for Researchers),
- 9 (Industry, innovation and infrastructure),
- and 17 (Partnership for the goals).

The departmental and interdepartmental research projects included in the strategic plan 2022-2025 contribute also to other goals: 3 (Good health and well-being), 6 (Clean water and sanitation), 11 (Smart cities and communities), 12 (Responsible consumption and production), 13 (Climate action), 14 (Life below water), 15 (Life on land), and 16 (Peace, justice and institutions).

Through active engagement in regional, national, and international networks, the University of Udine seeks to be a catalyst for knowledge and innovation, fostering a proactive ecosystem where research, education, and societal needs converge to generate smart solutions to the current challenges and create a brighter future for next generations. All of this within a vision coherent with the UN and EU strategies of sustainable development and working as part of a larger regional knowledge ecosystem.

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REPORT ON: KNOWLEDGE ECONOMY ECOSYSTEM OF CROATIA

This study has been prepared for the “Regional re-development through capacity building and creation of a research and development ecosystem with international partners” as a preparatory material for the Creative Europe project.

Prepared by IRMO expert

Introduction

According to the European Innovation Scoreboard (EIS) 2023, Croatia is in the group of Emerging Innovators being ranked as the 22rd country on the EIS 2023 scoreboard¹. This puts Croatia in the group of moderators with low innovation performance (69.6% of the EU average). However, performance is increasing at a rate higher than that of the EU (8.5%-points)². The inexistence of a systematic innovation policy in Croatia has previously been detected as a key reason for its low innovation competitiveness, which is why the *Strategy for Promoting Innovations of the Republic Croatia 2014 – 2020* was passed. Other reasons are found in the small participation of the business sector in research and development activities. The recent document *Smart Specialization Strategy until 2029* is the key national document complementing horizontal innovation policies with vertical and specific policies. The former *Smart Specialization Strategy for the period 2016-2020* stimulated private investments in research-development-innovation projects and was used as a tool for the absorption of ESIF funds.

The central problems innovations should help with is small per capita income compared to the EU average and economic vulnerability to external shocks as well as low productivity and economic diversification. The causes of the mentioned challenges are the modest impact of research and innovation, modest quality of research results, modest spill-over between research and business sector, and low innovation impact in the business sector.

Higher education is one of the essential prerequisites for creating a “knowledge society”, and is vital in times of crisis. Institutions in science and higher education represent foundations of good educational systems. The main body regulating the science sector in Croatia is the **Ministry of Science, Education and Youth (MZOM)**. Two main departments within the Ministry in charge of science-related policies and knowledge centres are the Directorate for Science and Technology and the Directorate for Higher Education. The *Directorate for Science and Technology* performs administrative and other tasks related to: the development of the science, technology and innovation system; the development of research and other institutions; the application of scientific achievements in certain fields; the harmonization of funding programmes with research projects; development and monitoring of intellectual property management policy by means of harmonizing national legislation on intellectual property rights with the *acquis communautaire*, and the development of strategic measures for improving the protection and enforcement of intellectual property rights in order to foster technology transfer from research organizations to the business sector and society; fostering continuous technological development in the Republic of Croatia; administering the Registry of Researchers and Research Organizations; monitoring and establishing scientific, professional and technological cooperation with foreign countries and international organizations according to international agreements;

¹ European Commission (n.d.). *European Innovation Scoreboard 2023*. Downloaded from: https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en#european-innovation-scoreboard-2023 (26/6/2024)

² European Commission (n.d.). *European Innovation Scoreboard 2023: Country Profile Croatia*. Downloaded from: https://ec.europa.eu/assets/rtd/eis/2023/ec_rtd_eis-country-profile-hr.pdf (26/6/2024)

enhancing the mobility of Croatian and foreign researchers; scholarships, specialization and practical training of domestic and foreign researchers based on international, government, business and other agreements; the administrative supervision of research organizations.

The *Directorate for Higher Education* performs administrative and other tasks related to: the development of higher education; the implementation of national strategies and higher education programmes; the provision of funding and facilities for higher education institutions and monitoring their activities; the preparation of reports on the activities and evaluation of higher education institutions and study programmes, and their recommendation for approval; the subsidization of study costs; the improvement of the student standard; monitoring success rates of study programmes and other higher education processes; administering the implementation of the Croatian Qualifications Framework; administering the Registry of Higher Education Institutions and the Registry of Study Programmes; managing databases on higher education; fostering lifelong learning and higher education for adults; the administrative supervision of higher education institutions³.

In accordance with the Decision of the European Parliament and the Council (2006/143/EC) and the European model of agencies for external quality assurance in higher education in 2004, the **Agency for Science and Higher Education** was established by the Decree of the Government of the Republic of Croatia. It is a public, independent, and internationally recognized agency that, in cooperation with stakeholders, promotes the continuous development of quality assurance in higher education and science to permanently improve the quality of higher education institutions and scientific organizations, contributing to the positioning and recognition of the Croatian area of higher education and science within the European higher education area and the European research area. The activities of the Agency relate to the following:

- Implementation of the external evaluation procedures established by the Law,
- Evaluation of the implementation of program contracts,
- Implementation of the process of recognition and evaluation of foreign higher education qualifications,
- Encouragement of the acquisition and expansion of knowledge and research on the quality system of higher education, scientific and artistic activities in the Republic of Croatia, and training for members of professional bodies in external evaluation procedures,
- Collection and processing of data on the higher education system, scientific and artistic activity,
- Provision of information on the requirements for admission to higher education institutions in the Republic of Croatia and consolidation of information on meeting the criteria for admission to higher education institutions,
- Performance of tasks of connection and inclusion in international associations and networks that deal with quality assurance in the system of higher education and scientific activities,

³ MZOM (n.d.). *On the Organisation*. Downloaded from: <https://mzom.gov.hr/about/on-the-organisation-1555/1555> (25/6/2024)

- Carrying out the evaluation procedures of higher education institutions and scientific institutes abroad and
- Performing the tasks in accordance with other regulations.

Quality higher education is a prerequisite for creating a successful society. Therefore, one of the main tasks of the Ministry of Science, Education and Youth is the creation of an intellectual foundation that will carry out this task with the support of universities, polytechnics, and colleges.

Apart from the Ministry and the Agency, other key institutions for the development of the knowledge economy are the following ones:

- research institutes,
- Croatian Academy of Sciences and Arts,
- Scientific centres of excellence,
- Centres of competence (CEKOMs), and
- Science and technology park.

In June 2024, the database of the institutions registered in the science sector counted 191 institutions, 25 of which were research institutes. There are nine public universities in Croatia. Other registered institutions comprise components of public universities, private universities, polytechnics, and legal entities outside the system of higher education and public research institutes that have registered scientific activity (e.g., National University Library, Croatian Academy of Sciences and Arts - HAZU, Lexicographic Institute “Miroslav Krleža”, hospitals and health institutions with research units, state institutes, archives, museums, etc.).

Research institutes cooperate with universities in research activities and execution of study programs and are divided into the following areas:

1. natural sciences
2. biomedicine and sciences
3. social sciences
4. humanities
5. technical sciences⁴.

⁴ Grbac, V. (2016). *Institucije u znanosti i visokom obrazovanju*. Downloaded from: <https://core.ac.uk/download/pdf/197586211.pdf> (26/6/2024).

In the mid-20th century, there was a tendency to separate institutes from universities to create specialized institutions that could fully dedicate themselves to scientific research, while universities continued to play a vital role in education and basic research. This process was driven by the need for greater autonomy in research work, better conditions for funding and equipping, and the possibility of focusing on specific scientific areas. The process of separation intensified during the 1950s and 1960s. In 1993, based on the Law on Institutions⁵, institutes became public institutions, and the Republic of Croatia acquired founding rights. At the beginning of the 1990s, the Law on Scientific Research Activities⁶ was established, which laid the foundation for the establishment of today's public research institutes owned by the Republic of Croatia.

The primary task of public research institutes is focused on developmental research with the long-term goal of achieving and strengthening their scientific excellence and international recognition. Scientific and technological research work and effectively transferring its results (innovation) into goods, services, and processes represent a crucial link in creating a competitive economy and a knowledge-based society.

At the end of 2023, a reform introduced a new funding model through program contracts (an instrument of public funding of scientific institutions amounting to 100% of their budgets). The four-year value (for 25 public research institutions with over 2,000 employees and two public higher education institutions) amounts to 453.827.843,57 euros⁷. These contracts enable institutes to manage their scientific activities independently, under national strategic goals, and based on results. In this way, a functional system for improving and developing the quality of science is established for the first time, allowing the full potential of the Croatian research sector to be achieved.

The Croatian Academy of Sciences and Arts (HAZU) is a scientific and cultural institution in the Republic of Croatia that aims to promote science and art and encourage Croatia's cooperation with other countries. It is based in Zagreb and is divided into several classes:

- for social sciences,
- for physics, mathematical, and chemical sciences,
- for natural, technical, and medical sciences,
- for philological sciences,
- for literature,
- for fine arts, and
- for music and musicology.

⁵ *Official Gazette 76/93, 29/97, 47/99, 35/08, 127/19, 151/22.*

⁶ *Official Gazette 96/93.*

⁷ <https://mzom.gov.hr/vijesti/ministarstvo-znanosti-i-obrazovanja-potpisalo-13-programskih-ugovora-s-javnim-znanstvenim-institutima-i-javnim-veleucilistem/5946>

⁸ <https://mzom.gov.hr/vijesti/ministarstvo-znanosti-i-obrazovanja-potpisalo-prvih-14-programskih-ugovora-s-javnim-znanstvenim-institutima-i-javnim-veleucilistima/5902>

It encourages and organizes scientific work and advocates for the application of achieved results; develops artistic and cultural activity and takes care of Croatian cultural heritage and its affirmation in the world; publishes the results of scientific research and artistic creativity; and gives proposals and opinions for the improvement of science and art in the fields which are of particular importance for the Republic of Croatia. It was established in 1866 as the Yugoslav Academy of Sciences and Arts, while in 1991, the Croatian Parliament passed a new law on HAZU as the highest scientific and artistic institution in the Republic of Croatia.

Scientific centres of excellence are research organizations or their organizational parts or entail a group of scientists who, by the originality, meaning, and relevance of their scientific results, are among the highest quality organizations or groups in the world within their scientific disciplines. They gather an interdisciplinary network of innovative scientists, scientific teams, and economic and public entities that systematically research topics of exceptional importance for science and society. These centres are established for five years, and based on evaluation, their status can be extended for another five years. Establishing scientific centres of excellence aims to recognize and evaluate researchers and scientific research that brings innovation, the potential for discoveries, or possible breakthroughs in scientific research to disseminate and promote the knowledge acquired through the centre's research activities and to manage it successfully. Additionally, they must be internationally relevant in terms of quality and vision and aligned with the strategic needs and priorities of the Republic of Croatia and the Strategy for education, science, and technology. In Croatia, there are 20 Scientific centres of excellence in the following areas: Biomedicine (4), Biotechnical Sciences (2), Social Sciences (1), Humanities (2), Technical Sciences (2), Natural Sciences (7) and Interdisciplinary - Biotechnical and Biomedical Sciences (2)⁹. Scientific centres of excellence are financed by the universities and through different EU funds (e.g., The Ministry of Regional Development and EU Funds of the Republic of Croatia within the Operational Programme Competitiveness and Cohesion 2021 – 2027 is financing projects that move the boundaries of research and knowledge and contribute to the development of new technologies and innovations in the thematic priority areas of the Smart Specialization Strategy until 2029. Total grant: 12.000.000 euros).

Centres of competence (CEKOMs) are individual (networked) entities driven by industry needs, designed to support the capacity building of the business sector, particularly small and medium-sized enterprises lacking their own research and development capabilities. They aim to conduct research and development projects, particularly those focused on applied research and the commercialization of results, aligned with thematic areas outlined in the Smart Specialization Strategy of the Republic of Croatia. A Centre of competence creates a shared space for the scientific and industrial sectors, bridging knowledge and experience between both sectors. The Centre is expected to implement research and development programmes demanded by the market, aiming to increase the application of research results from scientific institutions. This can involve creating new products and services,

⁹ <https://www.nvzvotr.hr/centri-izvrsnosti>

enhancing the market position of industries by adding value to existing products and services, transferring human resources, and fostering the creation of new companies or jobs.

Therefore, a Centre of competence links higher education institutions and research institutes on one side and industry on the other. Their primary goal is to enhance the competitiveness of the business sector through investments in research and development and to increase private sector investments in research and development. CEKOMs can be consortia between entrepreneurs and one or more research and knowledge dissemination organizations. In total, nine centres of competence focused on innovation and research were established. Some examples of Centres of Competence in Croatia are CEKOM 3LJ (established in the city of Trilj in 2015 to connect knowledge and experience from the science and industry for the development of new agricultural products) and CKOIE (established in 2021 as a private company) - Centre of competence for renewable energy sources, a research and development centre focused on applied research and the commercialization of research outcomes in renewable energy sources utilization. The centres received funding until the end of 2023, and so far the analysis of their results has not been available. Until the end of 2022, the Competence Centre for Advanced Production and Manufacturing in Karlovac showed the most impressive results. The owner of the Centre is the Karlovac based company HS Produkt, supported by partners RINEL Ltd. and FANUC Adria Ltd., the latter being number one in the world for robotics. The Centre received a grant of around 4.1 million Euro, which was used for infrastructure, i.e. renovation of one building, equipping a research centre, establishing laboratories for robotics, mechatronics and robotic vision, while employing five people. The innovations were to be developed through six projects, resulting in one to two prototypes, including automated robotic systems that would later be applicable in the metalworking industry.

The **science and technology park** is a commercial company established for the commercialization of scientific results, encouraging cooperation between scientists and businesses, and strengthening the fundamental economic sciences. The science and technology park enjoys tax benefits reliefs. So far, there is only one such park, the Science and Technology Park of the University of Rijeka Ltd. (STeP Ri), founded in August 2008 by the University of Rijeka with the support of the City of Rijeka and the Primorje-Gorski Kotar County as partners in the project. It is also part of the technological infrastructure development program - TEHCRO, co-financed by the Business and Innovation Centre of Croatia - BICRO d.o.o.). The purpose of establishing the Science and Technology Park is to encourage faster development through the synergy of the scientific, technological, and entrepreneurial potential of the University and the region, contributing to faster economic development and competitiveness of the region and the country. Since 2010, the Science and Technology Park of the University of Rijeka Ltd. has contracted more than 50 projects with a total value exceeding 28 million euros, of which STeP Ri's share is over 3 million euros¹⁰. The revenue increase compared to 2022 is 10.7%¹¹.

¹⁰ <https://www.step.uniri.hr/o-nama/>

¹¹ Data downloaded from <https://www.poslovna.hr/>

According to the Law on scientific activity and higher education, universities and public research institutes work on collaborative research programs, which are defined as interdisciplinary research programs that, as a rule, consist of a large number of scientific projects. These programs are proposed by the university senate or the scientific council of a public research institute.

A total of 158.754 students are studying at all universities in Croatia, of which 129.029 attend public universities¹². Croatia's oldest continuously operating university is the University of Zagreb, with more than 64.000 students. It was founded in the second half of the 17th century (namely, in 1669) and is among the oldest in Europe. The University of Split is the second largest public university, founded in 1974, with more than 18.000 students. The University of Rijeka and Josip Juraj Strossmayer University of Osijek, founded in the early 1970s, have more than 15.000 students. At the beginning of the 20th century, three universities were established, each in Dubrovnik, Zadar, and Pula (Juraj Dobrila University). Altogether, they have around 9.300 students. Although the University of Slavonski Brod was founded in 2015, the same year as the University North, it started working in 2020 and is considered the youngest Croatian university, with around 2.000 students¹³.

To help young researchers transfer their knowledge, the University of Zagreb established the Centre for Research, Development, and Technology Transfer (CIRTT). The role of CIRTT is to assist research groups at the university in securing financial support for research and development, to connect research groups with partners from the business sector, and to help establish collaboration in the development of technology and commercialization of intellectual property created at the university and to provide support to researchers and students in establishing companies and knowledge-based businesses. They also assist in launching spin-off companies that develop and commercialize research results from the University of Zagreb and its faculties. Another example is the Innovation Centre "Nikola Tesla" (ICENT). It is a non-profit institution, established in 2015, and owned by the Faculty of Electrical Engineering and Computing. It includes a series of research and development institutes focused on areas crucial for developing the Croatian economy. The primary role of ICENT is to bridge the gap between research in the academic and research community and the needs of the industry by creating innovative product prototypes based on scientific research for industrial purposes. By doing so, ICENT helps the Croatian economy by increasing revenue from new products, developing new high-value jobs, and introducing new technologies into Croatian industry. ICENT represents a comprehensive concept that networks the academic community, research institutes, the Croatian industry sector, the local and broader community, and the government. The interaction of these stakeholders ensures a space for multidisciplinary research and development, the rationalization of application and commercialization of results, and, consequently, the creation and improvement of a high-value-added industry. Since its establishment, ICENT has successfully finished twelve projects financed mainly by different EU programs, while six are ongoing, and one is in the preparation phase¹⁴.

¹² Broj studenata po akademskoj godini i vrsti ustanove (2022/23). Downloaded from: <https://www.azvo.hr/broj-studenata-po-akademskoj-godini-i-vrsti-ustanove-2022-23/>.

¹³ Broj studenata po akademskoj godini i nazivu ustanove nositelja (2022/23). Downloaded from: <https://www.azvo.hr/broj-studenata-po-akademskoj-godini-i-nazivu-ustanove-nositelja-2022-23/>.

¹⁴ <https://www.icent.hr/projekti/>

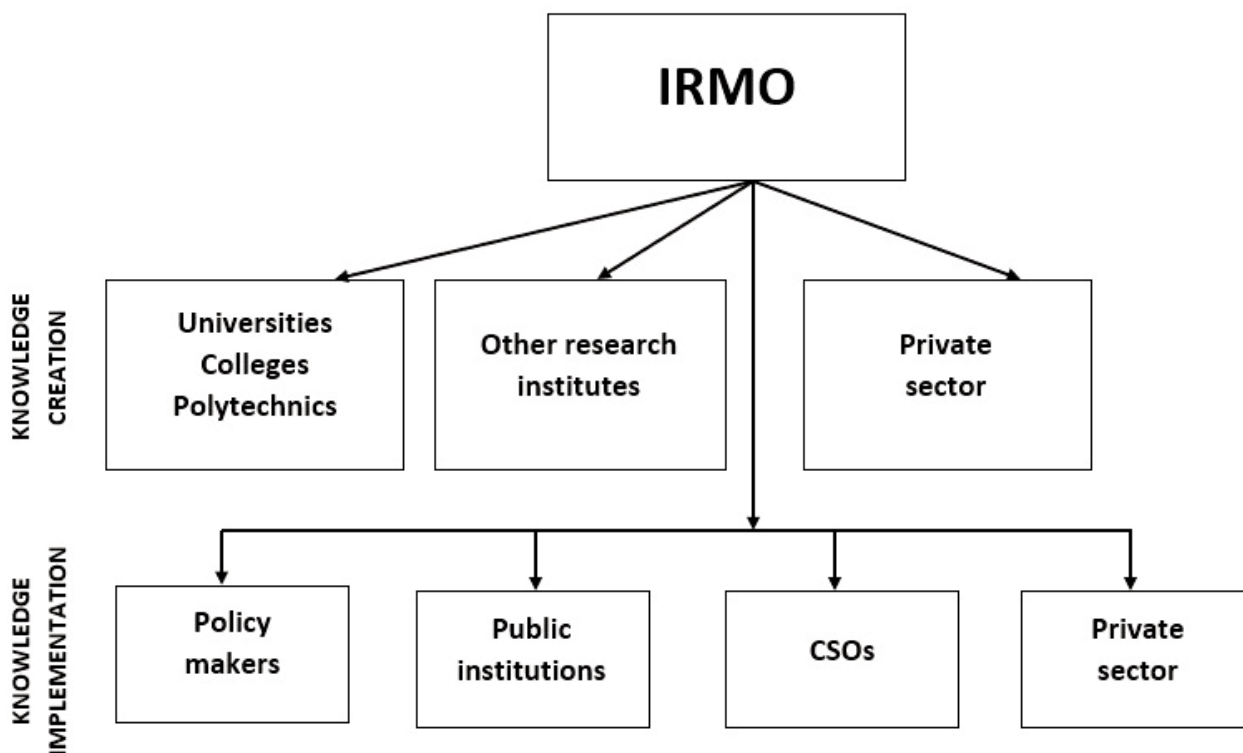


Figure 1. National relationships of IRMO with knowledge centres and other stakeholders
Source: authors' own elaboration

When it comes to our knowledge centre, the *Institute for Development and International Relations (IRMO)* is one of the 25 public research institutes and was established in 1963 as the Institute for the Study of Africa by decision of the University Council in Zagreb at the association with the Croatian Chamber of Commerce. In 1971, it became the Institute for Developing Countries. During its history, changes in the Institute's focus and program of work manifested themselves three more times in changing the Institute's name. 1989 it changed its name to the Institute for Development and International Relations, and in 1996 to the Institute for International Relations. In 2013, it returned to the title Institute for Development and International Relations. These name changes correspond to the Institute's five development periods. Sixty years of scientific work of the Institute for Development and International Relations reflect various development dynamics and fluctuating international connections worldwide. The Institute's research often preceded changes in the environment in which it operated. Most research programs were, and still are, characterized by interdisciplinarity and research flexibility. The latest research findings on hot topics make a good foundation for cooperation with universities, colleges, and polytechnics. Thus, individual researchers teach on some of them, while more formal cooperation resulted in the establishment of two study programmes: 1. "Post-graduate specialist study programme in the preparation and implementation of EU projects" (with the University of Zagreb, and currently also being prepared for Montenegro), and 2. Doctoral study programme "Business economics and sustainable development" (Libertas International University). The first study programme currently educated the 8th generation of students, which consequently impacts the enhanced number of enrolled students (285 enrolled students in 8 generations), increased skilled workforce,

and the number of applications and implementations of EU projects throughout Croatia. Recently, one of the former students also established the Centre for EU funds and education in the City of Slunj. The second study programme enrolled its first generation and it is still not possible to monitor the results.

In knowledge creation, apart from cooperation with higher education institutions, on the national level, IRMO cooperates with other research institutes (formal agreements with two institutes, but cooperation of individual researchers is much greater). This often results in knowledge implementation by offering consultancy services for policy makers in different areas of IRMO expertise, for public institutions and civil society organisations. Cooperation with the private sector is established on both levels, in knowledge creation by offering common research (partners united in consortia) and/or subcontracting of the private sector for some research topic, and in knowledge implementation when the private sector directly commissions research from IRMO. The following figure explains these national relationships of IRMO.

Internationally, cooperation with other knowledge centres is often established through common (usually European but also other projects), formal Memorandums of Understanding (entailing, e.g., common research, exchange of experience, common educational activities, exchange of literature, etc.), and membership in different international networks.

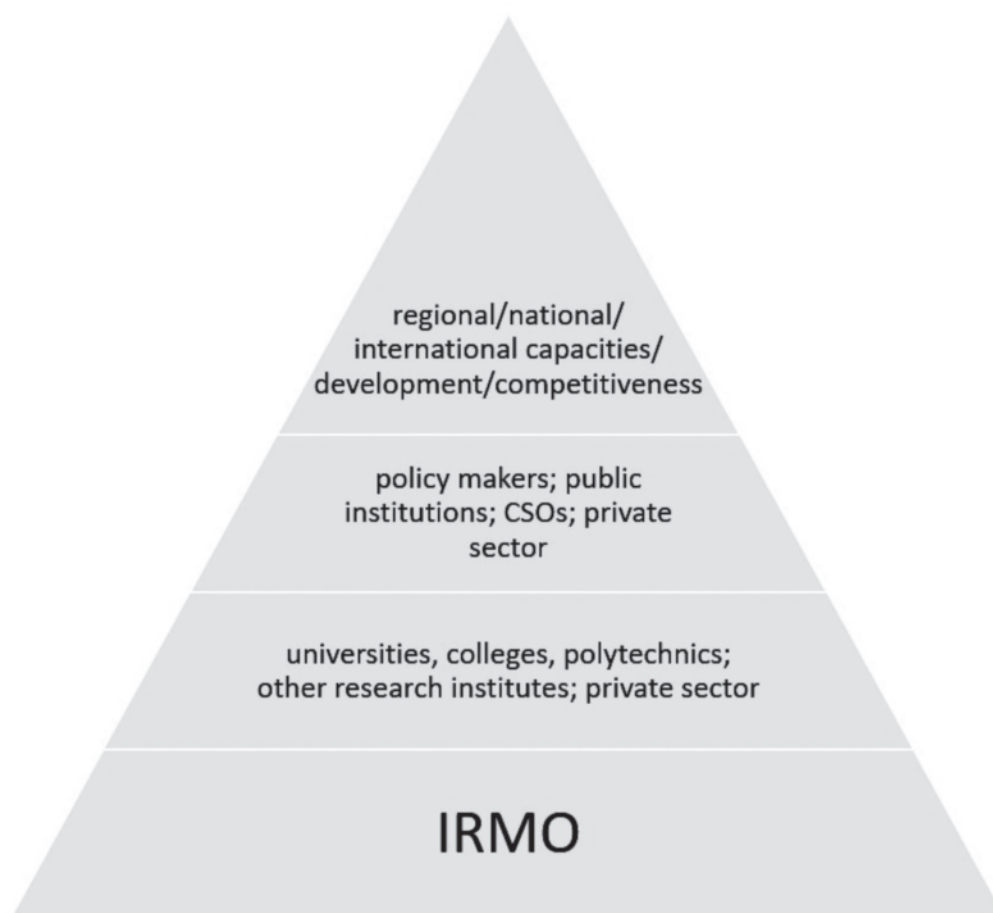


Figure 2. Mechanisms that sustain and improve the innovation ecosystem provided by IRMO

Source: authors' own elaboration

Apart from the already mentioned increased number of enrolled students, this cooperation results in a skilled workforce and consequently also in the increased number of EU project applications in a number of prepared strategic and planning documents for the policy makers in a number of management plans for public institutions; in increased capacities of public and civil society actors (by way of different training activities); and industry solutions.

The nature of IRMO research is mainly in the social sciences and is not prone to being measured by patents. The type of knowledge IRMO provides is either theoretical or applied. The applied research mainly serves as support (statistical reports, planning, strategic positioning) to innovation to be developed by other actors. Mechanisms that sustain and improve the innovation ecosystem can be modelled as follows.

The national *Smart Specialization Strategy until 2029* expects that the program interventions planned for smart specialisation until 2029 will improve the total Croatian innovation efficiency and capacities. IRMO, as one of the most competitive institutions in the national environment in strategic planning, international relations, and cooperation for sustainability, always aligns its research with national and international priorities or even provides the basis for determining priorities. Its developmental vision runs in that direction (see further text), and in the last ten years, substantial investments have been made in building IRMO researcher's capacities in strategic planning, project management, increasing the number and reach of scientific outputs, etc.

The very recent establishment of specialized centres within IRMO goes in that direction (Centre for Sustainable Development through Culture; Centre for Sociology of Media and Digital Society; Centre for the Migration Studies; and the revival of Culturelink¹⁵), which focus on specific contemporary topics but to link the existing researchers from different IRMO departments to promote transdisciplinary research. It is hoped that this will result in innovative research methods due to the transdisciplinary character of researchers.

Also, the established cooperation with universities will possibly result in new study programmes according to the needs of the environment, but also shorter training programmes are envisioned. Establishing the Foundation for Innovative Research in Culture has been considered, which would provide financial support for young researchers.

Further text provides more specific information on the topic in the IRMO context.

¹⁵ See further text.

A. What is the thematic focus (institutional profile, research topics, specialisation) of your institution's knowledge hub character?

The Institute for Development and International Relations is a public research institution established in 1963. Research activities are organized within for departments: Department for Culture and Communication; Department for European Integration; Department for International Economic and Political Relations; and Department for Resource Economics, Environmental Protection and Regional Development. IRMO conducts research mainly in social sciences, especially economics, culture, political science, sociology, and other related disciplines. However, in modern science, there is an increasing need for interdisciplinary and transdisciplinary linkages, therefore, depending on the project requirements, different research teams are formed. Thus, research is mainly focused on sustainable development, public policies, and international economic, political, and cultural relations through thematic units such as:

- public policy of the European Union,
- cultural, communication and media policies,
- policies of regional, local, urban and rural development,
- environmental policies (bio-economy, environmental protection),
- energy and climate policies,
- economic policies (competitiveness, entrepreneurship and innovation),
- external policy,
- European Security and Defence Policy.

Part of its applied research is conducted by the Institute for the needs of public administration, state administration bodies, agencies and local and regional self-government units. This provides a scientific basis for the design, implementation and evaluation of public policies in a number of areas of economic, social and cultural life of the Republic of Croatia. As a partner of foreign research institutions, the Institute participates in scientific research and the preparation of professional studies within international programs and projects. In particular, the Institute's international networking has emerged in the implementation of projects funded by programmes and funds such as IPA, INTERREG, Horizon 2020, Horizon Europe, ERASMUS+ and the Trans-Atlantic Platform, as well as in bilateral cooperation programmes and international organisations such as the World Bank, UNDP and UNESCO.

IRMO defined its mission and vision in the 2017-2027 Development Strategy.

IRMO's mission is to:

To carry out top scientific and research work and transfer of knowledge and skills in the field of international economic, political and cultural relations for sustainable development of the Republic of Croatia.

IRMO's vision is:

IRMO is an excellent European scientific research institution in the field of international relations and cooperation for sustainable development.

B. How do you link higher education institutions and human resources in the region (workshops, events, joint projects, collaborations)?

The Institute's prime focus is directed towards enhancing scientific productivity and applicability of scientific research through promoting research partnerships and strengthening of the research environment for young scientists, combined with the enhancement of Croatian scientists' participation in the EU framework or other international programs and platforms. Cooperation through workshops, study visits and conferences involving international and domestic scientists and experts enables networking and sharing experiences with stakeholders regarding similar development potentials. Also, IRMO is the focal point of the *Culturelink Network*, Network of Networks for Research and Cooperation in Cultural Development, established by UNESCO and the Council of Europe in 1989. It used to have more than 1500 members all over the world, and, although not so active lately, IRMO still maintains very close contact with some of its members by cooperating in different activities. Further on, IRMO is a member of the *Trans European Policy Studies Association (TEPSA)*, the first EU affairs pan-European research network comprising leading research institutes throughout Europe: *European Association of Development Research and Training Institutes (EADI)*, *European Regional Science Association (ERSA)* and *Croatian Association for Sustainable Development*. Individual IRMO researchers are also members of different professional associations (e.g., Interpret Europe - European Association for Heritage Interpretation; European Association for Social Psychology; Croatian Fulbright Association) and have prominent positions in some of them (e.g. European network on cultural management and policy – ENCATC; OLES – Open Lab for European Studies). Besides, they are members of editorial boards in scientific journals (e.g., *The European Journal of Cultural Management and Policy*; *Turyzm/Tourism*, etc.). Regularly, on a monthly basis, IRMO in cooperation with the Croatian office of Hanns Seidel Stiftung (HSSt) publishes a series of publications (policy briefs), dealing with different topics in the field of contemporary international relations, thus involving a number of researchers as contributors. Also, some IRMO researchers have performed research scholarships hosted by research organizations/universities (e.g. Hungary, Slovakia, Canada, USA) or have hosted internship researchers in the IRMO premises.

C. What is the specific role of your institution in the development of knowledge networks (organisation, location, initiatives, own projects)?

IRMO acts as a lead or regular partner in a number of European projects through which knowledge cooperation networks are formed. Furthermore, it organizes conferences/meetings/workshops involving domestic and international researchers and regularly produces the *IRMO brief* online publication involving a number of researchers within its cooperation contacts. Smaller meetings are also

organized at the IRMO premises. The Culturelink Network, with its focal point in IRMO, is a valuable global knowledge network; it has decreased its activities with the passing of its director but is currently being revived with new leadership.

D. As a regional thematic knowledge centre, how can your institution cooperate with governmental or strategic development actors (on local, regional, national or international levels)?

As mentioned before, IRMO is intensely engaged in providing applied research studies and strategic and planning documents for public administration, state administration bodies, agencies, and local and regional self-government units. This provides a scientific basis for the design, implementation, and evaluation of public policies in a number of areas of the economic, social, and cultural life of the Republic of Croatia. So far, IRMO has provided a number of development strategies for different cities and counties as well as thematic development strategies (e.g., in the field of culture, tourism, entrepreneurship and SME development, digitalization, green infrastructure, etc.) either on the local, regional, or national levels. Moreover, IRMO is nationally recognized as a Zagreb school of cultural policy for its expertise in culture. Also, it has been engaged in preparing management plans for different heritage sites (often registered in the national heritage databases or by UNESCO). On top of that, IRMO researchers have been active as evaluators for different strategic documents (ex ante, mid term and ex post). Furthermore, IRMO has organized various training courses for public administration.

E. How would you describe the processes and steps of knowledge sharing in your region?

Except for the already mentioned IRMO recognition in the public perception as a Zagreb school of cultural policy where knowledge sharing is done through the provision of policy advice and preparation of different policy and planning documents, there are several ways in which IRMO is involved in knowledge sharing in the region. First, through individual initiatives of groups of IRMO researchers, such as the publication of a guidebook series (e.g., Cultural heritage in practice), which is then promoted via conferences, meetings, and events (e.g., heritage days). Second, through establishing two study programmes: 1. "Post-graduate specialist study programme in the preparation and implementation of EU projects" (currently also being prepared for Montenegro), and 2. Doctoral study programme "Business economics and sustainable development". Third, through the organization or participation in conferences, meetings, and workshops. Fourth, through memberships in different associations. Fifth, through engagement of individual researchers in university or business schools teaching. Six, through the organization of other activities for science popularization. Seven, through mobility programmes (internal and external mobility), etc. Although IRMO is very active in all the mentioned, it has to be pointed out that these activities have not been planned top-down but are created by proactive individuals or as a response to an opportunity.

F. Describe some good practices you have developed in terms of successful cooperation with other actors.

- Close ties with researchers or project partners previously worked with, which leads to new cooperation projects;
- Close ties policy makers previously worked with - based on the quality documents previously delivered, IRMO is often engaged for further projects;
- Culturelink Network;
- Own projects (e.g., the one funded by the UNESCO IFCD) striving to develop a database of creative professionals (for Zagreb) for the promotion and development of the creative industries (although the idea did not work as planned, the project-related data and materials are still used).

G. Are there any noteworthy creative dimensions, innovative methods and approaches of the Knowledge Centre's activities that fit into the Creative Europe programme's concept and framework?

So far, IRMO has not focused on the topic of virtual worlds, innovative business tools (AI, big data, blockchain, Virtual Worlds, NFT, etc.), or greener practices in knowledge sharing, although some of its research and activities included AI, and marginally also virtual worlds. Regarding greener practices, a number of research studies included it (e.g., related to marine waste, climate mitigation, sustainable tourism, green culture and heritage, etc.).

H. Describe some development projects in the region in which your Knowledge Centre has played an active role.

The IRMO knowledge center played a prominent role in creating development plans and programs and defining strategic development projects at the local and county levels. We participated in creating the development index for the Republic of Croatia and in the analysis of the development of Croatian islands. We have developed the foundations for a number of national development sector strategies, such as the analytical basis for cultural development strategy, tourism-sustainable development strategy, and bioeconomy development strategy. Furthermore, we have offered development breakthroughs for the use of enabling technologies in the economic sector (Boosting a novel and innovative training approach of key enabling technologies – BRACKET, ERASMUS+ project) and developed the basis for the digitalization of entrepreneurship (GIST - Encouraging digitalization and bionic transformation of small and medium-sized companies through innovative training to overcome the COVID-19 crisis ERASMUS+ project).

I. What traditional and creative methods/techniques are used to share knowledge generated in the R&D ecosystem?

- Publishing activities
- Conferences/meetings/workshops, etc.
- IRMO website and its social networks, as well as individual social networks
- Monthly publication of the *IRMO brief*
- Activities related to popularization of science (book launches, public lectures, work with children, *IRMO aktualno* – monthly publication on the IRMO website on the topics of IRMO research which correspond to hot global topics, etc.)

REPORT ON:
**KNOWLEDGE ECONOMY ECOSYSTEM OF THE
REPUBLIC OF NORTH MACEDONIA**

This study has been prepared for the “Regional re-development through capacity building and creation of a research and development ecosystem with international partners” as a preparatory material for the Creative Europe project.

Prepared by the experts of The Center for Advanced Researches, Skopje, The Republic of North Macedonia.



The Center for Advanced Researches
Skopje, North Macedonia

Introduction

The Center for Advanced Researches (CAR) is a think-tank organization that unites intellectuals of all generations (including retired professors) for the development of scientific thought, with focus of social sciences and humanities. Through scientific research and debates, the center provides valid and useful forecasts to explain contemporary phenomena. The task and responsibility of the Center for Advanced Researches is to help navigate through complexity and uncertainty, contributing to the formulation of answers to questions that require more complex and interdisciplinary thinking. The leadership of the Center for Advanced Researches consists of eminent and proven experts and professors in their field, but also in the public life of the Republic of North Macedonia.

The CAR experience is based on more than 15 years' work within the community, addressing citizens' problems and needs and helping in overcoming challenges. CAR provides workplace for people from different ethnic and social backgrounds and offers non-formal education in the fields of project management and employment skills.

Hinterland situation of The Center for Advanced Researches - The Republic of North Macedonia

The Republic of North Macedonia is a multicultural society that abounds with a large number of different cultures, ethnicities, and religions. Most of Macedonian society is ethnically divided, polarized and segregated, and serious attempts must be made to bring communities closer together, stop discrimination and strengthen participation in democratic processes.

Ethnic diversity is one of the characteristics that define the Republic of North Macedonia. Maintaining stable inter-ethnic relations is a necessary prerequisite for stability and democracy in the country.

The lack of social cohesion is the main reason for the instability of inter-ethnic relations. Social cohesion is the feeling of belonging to a common space or the degree of consensus of the members of a community. According to the social interaction within the social group, there will be more or less cohesion.

In the research report on the influence of stereotypes and ethnic distance on the occurrence of

discrimination, hate speech and hate crime published by the OSCE mission in Skopje, it was concluded that “segregation in society can be observed in the fact that most of the respondents they live in ethnically homogeneous neighbourhoods which is mirrored within the framework of social interaction where the close environment outside the family, related to the friends they hang out with, is also ethnically homogeneous, that is, there is insignificant interaction with other ethnic communities.

In the opinion of the Advisory Committee of the Framework Convention for the Protection of National Minorities of the Council of Europe of 21 September 2022, it is recommended that the authorities increase the socio-economic participation of persons belonging to national minorities living in rural areas by investing in infrastructure and opportunities for employment and aimed at supporting youth from minority communities.

Strategic aims of The Center for Advanced Researches are the following:

- 1 Improvement of the living conditions and standard of life
- 2 Strengthening of the democracy and civil society
- 3 Vocational Education and Training
- 4 Economic development
- 5 Social services, cohesion and inclusion
- 6 Improving inter-ethnic relations

Highlighted program activities of The Center for Advanced Researches

Within its program activities, the CAR address the need of the citizens mainly in regards to the multicultural understanding and intercultural communications, social inclusion, social services, employability, as well as issue concerning poverty and economic development.

The CAR operates at local, national and international level, providing services and conducting activities in different regions, and in partnership, in various countries.

CAR’s programs aiming to contribute towards better social inclusion and improved life conditions with the following ways:

- Support for marginalized citizens and groups
 - Support for long term unemployed coming from low-income families
 - Vocational education and training for unemployed
 - Special support programs for people with disabilities

- Capacity building for local grass root groups and organizations for emergency situations
- Resource center - The CAR provides services for local action and community groups, training facilities and office space, as well as training resources.

Link to the higher education institutions and human resources in the region (workshops, events, joint projects, collaborations)

The Center for Advanced Researches is one of the founders of the Academic Cooperation Network in Southeast Europe, in 2018. Research on multiculturalism and the protection of the rights of national minorities are in the focus of the Academic Network. We are convinced that science can contribute to better social relations and better understanding in Southeast Europe in order to make a stable and developed region.

In 2021, the Center for Advanced Researches organized an international conference “The spirit and shadows of Yugoslavia: Reflections and processes 30 years after the disintegration of the SFRY”, which was held in Skopje, on June 25, 2021.

On networking with other members of the Academic Network for Cooperation in SEE, we are organizing many international conferences, workshops and other events, for exchanging of information, experiences and knowledge, like is annual conference in Brujini, Croatia. As networking activities, we published several books and other publications. This year 2024 is published a complex and interdisciplinary international study with a title “Changes”, where are analyzed and explored a big spectrum of processes and phenomenon that were happen and appeared in the area of former Yugoslavia in last 3 decades.

The specific role of the Center for Advanced Researches in the development of knowledge networks (organization, location, initiatives, own projects)

Started from 2013 Center for Advanced Research is organizing regular annual International Conference on Cultural Heritage, Tourism, and Sustainable Local Development. So far, 12 volumes of conference proceedings have been published. In these conferences participated more than 500 scholars and experts from more than 30 countries, around the world. Conference is holding in Ohrid, on 17-19 January every year before the holiday of Epiphany, that is also a touristic attraction in this ancient city.

In a last two years (2022 and 2023), the Center for Advanced Researches realized the Summer School for the Protection of the Rights of Communities and Multiculturalism. More than 40 students from different universities, faculties and institutions, in the first and second cycle of studies participated in the summer schools and gain additional knowledge and networking in these specific realm.

Development projects in the region in which the Center for Advanced Researches has played an active role

CAR was deeply involved in preparation and implementation of a National Strategy for “One Society and Interculturalism” 2020-2022, and of the National Strategy for Interculturalism and Social Cohesions, approved by the Government of the Republic of North Macedonia in February 2024, as well as on gathering academic, educational institutions and businesses sector in addressing the challenges and needs of the disabled and vulnerable groups. National strategy for One society and interculturalism from 2020-2022, as a document that was prepared for the first time in the Republic of North Macedonia, taking into account the division of society on various grounds, and is the first strategy for interculturalism in Europe. The strategy 2020-2022 initiated activities to strengthen the processes of communication and cooperation between communities in the direction of creating a society in which everyone will feel like an equal member of society. The Center for Advanced Research as an institution, as well as individuals form the Center, took an important part on drafting and implementing of the Strategy.

The latest opinion of the Advisory Committee of the 2022 CoE Framework Convention for the Protection of National Minorities (RCNM) states that North Macedonia has made significant progress in the legal protection of the rights of persons belonging to national minorities, especially in the field of anti-discrimination and the use of the Albanian language in the past few years. However, the Advisory Committee urgently recommends that “the authorities take further steps towards promoting an integrated society based on respect and trust between different communities.” To ensure the sustainability of the One Society for All Strategy, the authorities need to ensure high-level political support, solid funding and accessibility to practitioners in education, the media and civil society, as well as to the general public. In that direction Center for Advanced Researches made some training and seminar with the members of the Parliament for better understanding of recommendations of the Advisory Committee.

A project “Inclusion of Marginalized Groups in the GIG-economy (MarGIGIn)”, Center for Advanced Studies implemented in 2023 as cross-border action with a Bulgarian organization “Human Resource Development Center”. An aim of this project was to strengthening the inclusion, promotion and em-

ployment of marginalized groups by implementing then innovative career counseling model and socio-economic integration in the conditions of the GIG-economy, in border region cities of Kriva Palanka (North Macedonia) and Kjustendil (Bulgaria). A Center for Advanced Studies in a city of Kriva Palanka, trained 10 women for a period of 6 months by the so- called CH- model for development of the professional carriers. Project was supported by the Erasmus + program.

Planned model project for knowledge sharing through civil society organisations

Taking part in a project promoting civil society organisations' awareness of capacity building and implementation of the EU Charter of Fundamental Rights is based on the fact, that the organization is providing support and offering services to the community, aiming to improve the living conditions and the standard of life of citizens, particularly taking into account the needs of people with disabilities. The CAR pays special attention to the marginalized and people with fewer opportunities and within its social inclusion portfolio is trying to address their needs.

The project will strengthen the capacities of the organization and other partners, institutions and stakeholders who have interests in policies for social cohesion, non-discrimination, inclusion, multicultural society, fight against hate speech, etc. Through the project, the CAR will include a larger number of people from marginalized groups and we will develop human capacities that will be trained for development policies and activities related to social cohesion. The same applies to partners and collaborators, target groups and end users, because in general in North Macedonia there are weak capacities for this issue, which is one of the key ones in the future period of EU membership negotiations. In that way, through the acquisition of knowledge and built capacities, the organization, partners and collaborators, as well as target groups and end users will become entities and subjects that can be seriously considered as partners in the process of joining the EU.

The sustainability of the project will be ensured by preparing women from national minorities for advocacy to improve social cohesion. Flexible methods will give them the opportunity to "try out" during project implementation how to apply for funds from the regular "core" budgets of agencies (governmental, non-governmental or intergovernmental) in the region.

During the project, applicants and the implementation team will encourage and connect them with civil sector organizations to apply for funds.

The trainings will provide the necessary skills such as conducting surveys, analyzing results, compiling contextual observations, etc. Trained participants will further be able to do independent analyses, shadow reports, problem identification, etc. Part of the training results will be the institutionalization of new jobs. According to past experiences, mainly in the case of local mediators,

it has been proven that local and national authorities (schools, health, local administrative authorities, police, ministries, state agencies, etc.) will be happy to employ these qualified people for representation.

One of the concrete results of the project will be networking. In addition, there will be network strengthening and exchange of experiences at local, national and international levels, database creation and knowledge sharing.

The project tries to identify (structural) obstacles to effective inclusion in public life, non-discrimination and social inclusion, to raise the issue at the appropriate level, seeking to make the necessary changes.

The main result of the project is to create a new network between the civil and the academic sectors, which can further act as a powerful new channel of communication and knowledge-sharing.

Key experts of The Center for Advanced Researches

Rubin Zemon Ph.D. – qualification - Ph.D. on Cultural Anthropology (Ethnology). His activity in the civil sector in the country and abroad is recognizable as activists for protection on the rights of national minorities, development of the multicultural society and intercultural relations. The Council of Europe, as well as the OSCE / ODIHR have repeatedly hired him as an expert / consultant on various missions, projects and issues related to national minorities and multiculturalism, in various European countries, especially in the countries of South-Eastern Europe. In 2018, he was appointed as Special Adviser to the Prime Minister of the Republic of Macedonia for the development of multicultural society, interculturalism and intercultural communications. From that position, he initiated and initially led the preparation of the government's National Strategy for Development of the Concept of One Society and Interculturalism, which is in fact the first such state strategy for interculturalism in Europe.

Ana Chupeska Ph.D. – qualification - holds Master of Science in IR and PhD in Political Science. As Professor at Political Science Department ("Iustinianus Primus" Law Faculty, University Ss. Cyril and Methodius - North Macedonia) she teaches several subjects ; there she is also the Head of Political Science Master Collegium. She has experience in NGO Transparency Macedonia and a Vice President of Macedonian Political Science Association. Ana Chupeska is a member of the FEPS Scientific Council .

Emina Rustemoska Ph.D.- qualification - holds a PhD in Urban Sociology and a Master's degree in European Union Integration. Throughout her extensive experience in the non-profit sector, she has worked on developing and implementing policies related to youth empowerment and gender equality. Her expertise includes the preparation of policy papers and contributing to the design and implementation of public policies, particularly in areas concerning social mapping and gender-based analysis. She is deeply committed to advancing women's rights and inclusion, with a specific focus on promoting gender balance and addressing systemic inequalities affecting women. Her work aims to foster inclusive societies where gender equity is a central pillar of policy development.

**A kiadvány a Miniszterelnökség KÁF/185/2/2023 iktatószámú
költségvetési megállapodása szerint finanszírozott támogatásból valósult meg.**

