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Study of the Technology Transfer Ecosystem of ROMANIA

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Comprehensive Study Of The Technology Transfer Ecosystem

Content

1 Introduction

This report presents a comprehensive analysis of the technology transfer (TT) ecosystems in Greece, Bulgaria, Türkiye, and Romania, conducted by four leading institutions specializing in innovation and technology commercialization. These institutions include the Centre for Research and Technology Hellas (CERTH) in Greece, the Bulgarian Association for Transfer of Technology and Innovation (BATTI) in Bulgaria, Karadeniz Technical University Technology Transfer Application and Research Center (KTU TTC) in Türkiye, and the "Dunărea de Jos" University of Galați (UDJG) in Romania.

The study is part of the broader "Technology Transfer and Innovation Network for the Black Sea Basin" (T3N-BSB) project (https://t3nbsb.net/), which is funded under the Black Sea Basin Cross-Border Cooperation Program for the 2021-2027 period. T3N-BSB aims to develop sustainable transnational networks and platforms to facilitate the exchange of best practices and knowledge on leveraging innovative technological advancements. With a budget of €498,120.00, the project fosters stronger collaboration among academia, industry, and policymakers, ensuring technology transfer processes are more effective across borders. By enhancing institutional capacities and interconnectivity, T3N-BSB seeks to create a robust ecosystem that supports economic growth through innovation and research commercialization in the Black Sea region.

- **Significance of the Study**

Despite Romania's considerable scientific resources, much of the research output remains unutilized due to limited technology transfer infrastructure. This study aims to identify current gaps and propose solutions to enhance collaboration between academia and industry. Technology transfer in universities and research institutes goes beyond commercializing inventions; it also involves nurturing entrepreneurial skills in students and researchers. This study will analyze the integration of entrepreneurship education in Romanian universities and suggest improvements. Romania's technology transfer ecosystem is fragmented, lacking effective coordination among universities, research institutes, the private sector, and public administration. This disconnect hinders the commercial value of many research projects. A cohesive study can help integrate these entities into a unified ecosystem that not only drives economic growth but also addresses sustainable development goals. Through promoting ecological and social innovations, Romania can address pressing challenges such as climate change, natural resource management, and sustainable infrastructure.

The European Innovation Scoreboard 2024 highlights that Romania has made significant strides in research quality, with a 33.8% increase in globally recognized scientific publications since 2017, showcasing the country's scientific impact. The 12.8% rise in foreign PhD students indicates a more internationalized academic environment with growing competitive potential. However, Romania remains at 37.7% of the EU average in terms of research attractiveness, suggesting persistent constraints that prevent the country from reaching the performance levels of

other EU nations. (European Commission, General Directorate of Research and Innovation, 2024).

- **Existing challenges**

One of Romania's biggest obstacles to innovation is the shortage of qualified human resources in research and development (R&D). While the quality of research has improved, Romania scores low in human resources, with performance at less than a third of the EU average. Key reasons for this gap include:

- Many researchers and PhD graduates leave Romania for better opportunities abroad, drawn by higher salaries and more advanced research facilities.
- Research careers in Romania lack adequate promotion and support, which deters young graduates from pursuing academic or industrial research, weakening the country's innovation capacity.
- Public and private R&D funding in Romania is significantly lower than in other EU states, reducing the appeal of research careers for both local and foreign talent. Limited funding affects research infrastructure, which in turn constrains the development of innovative projects.

The decreasing number of PhD graduates who stay in Romania's R&D and technology transfer (CDI-TT) system negatively impacts the country's innovation potential. In a knowledge-based economy, a shortage of specialized R&D professional's limits Romania's ability to generate ideas, develop technologies, and drive growth through innovation. To address these challenges, Romania requires policies that improve research career attractiveness through competitive salaries and long-term career paths, increase investment in research infrastructure, and provide incentives to retain young researchers.

- **Methodology:**

The study will extend to all relevant sectors and regions, focusing on challenges, opportunities, and barriers that impact knowledge and technology transfer from academia and public institutions to the private sector. Specifically, the analysis will consider the role of universities and public research institutes in fostering entrepreneurship through business incubators and Technology Transfer Entities accredited by ReNITT. Given the limited data on actual transfers, the study will cover all economic sectors to provide a comprehensive perspective.

- **Coverage:**

The study will extend to all relevant sectors and regions, focusing on challenges, opportunities, and barriers that impact knowledge and technology transfer from academia and public institutions to the private sector. Specifically, the analysis will consider the role of universities and public research institutes in fostering entrepreneurship through business incubators, Technology Transfer Entities accredited by ReNITT [1] and Regional Centers for the Promotion of Property [2]. Given

[1]The register of accredited entities from the innovation infrastructure and technology transfer in accordance with the specific methodological norms approved by HG 346/2023 available at https://www.mcid.gov.ro/sistemul-de-cercetare/infrastructuri-de-cercetare /entitati -of-innovation-and-technological-transfer/

[2]The Regional Centers for the Promotion of Industrial Property in OSIM, available at https://www.osim.ro/despre-osim/link-uri-utile/centre-regionale

the limited data on actual transfers, the study will cover all economic sectors to provide a comprehensive perspective.

- **Limitations**:

While the study seeks to provide a broad evaluation of the technology transfer ecosystem, some limitations may affect the findings, such as restricted access to confidential data (related to GDPR or trade secrets), incomplete data, or limited public information.

- **Practical Implications**:

This study will outline the barriers and opportunities within Romania's technology transfer ecosystem, offering insights for policymakers, technology managers, and other stakeholders. The findings can inform the development of policies and programs that effectively foster academia-industry collaboration, increase research and innovation funding, and promote the use of intellectual property rights within entrepreneurial activities. Specifically, the study highlights the potential benefits that the entrepreneurial sector could realize by working with R&D institutions to solve technological issues and improve resource efficiency. The study also seeks to address regional disparities by fostering cooperation across different development regions. By examining the technology transfer ecosystem, this research will have valuable practical implications for a variety of stakeholders, from policymakers and entrepreneurs to researchers and investors. It will contribute to optimizing innovation processes, strengthening academia-industry partnerships, and promoting sustainable economic development in Romania.

2 Historical background and current status

The history of technology transfer in Romania reflects an evolution closely related to the major economic and political changes in the country. The technology transfer ecosystem began to take shape in the 1990s with the transition from a centralized to a market economy but was preceded by a distinct period of state-organized research and development that took place during the communist period. During the communist period, research and technological innovation controlled by the Romanian state. Research institutions, design and production institutes (such as IFA – Institute of Atomic Physics) had precise goals in supporting key industries (electronics, energy, metallurgy, etc.). The transfer of technology took place in a limited way and was carried out within the framework of strategic partnerships with other communist states, especially within the Council of Mutual Economic Assistance (CAER), established on January 25, 1949 at the initiative of the USSR, as an organization of communist states (https://www.descopera.ro/, 2018). During this period, Romania invested significantly in the infrastructure of technical education and research, laying the foundations for a future potential of technological development. After 1989, many of the state research institutions lost their funding and researchers faced major challenges due to lack of resources and economic crises. However, Romania entered a period of transition to a market economy, which created a favorable environment for the establishment of the first private and collaborative technology transfer initiatives. During this period, the

first organizations appeared that began to connect academic research with the private sector, but these initiatives were still fragmented and insufficiently structured.

In the 2000s, Romania's accession to the European Union (2007) had a major impact on the technology transfer ecosystem. Romania benefited from European funds for innovation, research and development. In this context, the first TTOs (Technology Transfer Offices) began to develop in universities and research centers, especially around the largest technical universities in the country, such as the Polyethnic University of Bucharest, the Technical University of Cluj-Napoca and other centers regional of innovation.

Such an entity was also created within the "Dunărea de Jos" University of Galati, namely the Department of Continuous Training and Technological Transfer. The chair was created through the TEMPUS project of the European Community, JEP 11243-96, having as its object of activity the training of personnel from inside and outside the academic community through initiation, specialization, improvement courses, etc. The department operates based on the Order of the Ministry of National Education no. 25.944/1.02.1999.

Within this structure, in 2015, the authorization procedure of the first regional innovation and technology transfer entity, namely the CTT-UGAL (Technology Transfer Center –" Dunărea de Jos" University of Galați"), was initiated. CTT-UGAL was established within the Galați "Dunărea de Jos" University of Galați, according to the Decision of the Board of Directors of the Galați "Dunărea de Jos" University of Galați No 14/02.04.2015 and was accredited as an entity in the national infrastructure of innovation and technological transfer ReNITT through OMCI no. 722/27.11.2017. The CTT-UGAL was re-accredited through OMCID no. 20482/13.04.2023 being found at position 42 in ReNITT of the Ministry of Research, Innovation and Digitalization *https://www.mcid.gov.ro/sistemul-de-cercetare/infrastructuri-de-cercetare/entitati-de-inovere -and-technological-transfer /*

The UGAL technology transfer center is established and operates in accordance with the provisions of the Higher Education Law no. 199/2023, of Government Decision no. 346/2023 on the approval of the Methodological Norms regarding the establishment, operation, evaluation and accreditation of entities from the innovation and technological transfer infrastructure, as well as the manner of their support (Departamentul de Formare Continuă și Transfer Tehnologic, 2024). The accreditation areas for which the UGAL Technology Transfer Center offers technology transfer services are Bioeconomy, Environment and Eco-technologies, Energy and Mobility.

The Horizon 2020 research and innovation framework program provided funding and support for the development of technology transfer capabilities and the commercialization of research results. In the same period, Romania started to develop industrial clusters and technology parks. A notable example is Măgurele Scenic Park, which supports technology transfer in advanced fields such as laser

physics by hosting the Extreme Light Infrastructure – Nuclear Physics (ELI-NP) project, an international research center in laser physics.

In the recent period (2010 - present), the structure of technology transfer organizations and innovation support organizations within universities and research institutes in Romania has been consolidated. These have become important tools for facilitating collaboration between academia and industry. The Romanian Association for Technology Transfer and Innovation (ARoTT) is one of the leading organizations supporting innovation and technology transfer activities at the national level, promoting cooperation between researchers and companies (Romanian Association for Technology Transfer and Innovation, 2024).

In recent years, Romania has experienced growth in the TECH start-up sector, especially in the field of IT and emerging technologies. This has led to the creation of a more conducive environment for technology transfer through accelerators, business incubators and investment funds that support innovation. There is increased interest in fields such as artificial intelligence, robotics, renewable energy and biotechnology. Romania actively participates in European innovation and research networks, strengthening the connection with international technology transfer networks. Although there is a growing technology transfer infrastructure (Ministerul Cercetării, Inovării și Digitalizării (MCID), 2024), challenges remain, such as the lack of more effective cooperation between academia and the private sector, bureaucracy and research underfunding. Romania has great potential in areas such as IT&C, green energy and space technologies. A deeper integration into the European innovation ecosystem and the creation of clear national policies to support research and innovation are essential for future development.

2.1 Overview

- **Early Initiatives in Technology Transfer**

Technology transfer in Romania started gradually, being influenced by historical, economic and political developments in the region. In the interwar period, Romania began to develop a scientific research infrastructure. The universities of Bucharest, Iași, Cluj and Timișoara have played an important role in the training of research personnel, especially in fields such as engineering, chemistry and natural sciences. Although technology transfer was in its infancy, early collaborations between academia and industry began to emerge, particularly in areas such as oil and agriculture. Romania, as one of the most important oil producers in Europe, was one of the first countries to develop research institutes in this field. Collaborations between the private sector and research institutes began to become more common. After the Second World War and the establishment of the communist regime in 1947, Romania entered a period of centralization of research and innovation. The state took complete control over industries and instituted centralized planning of economic and scientific activities. In the 1950s and 1960s, Romania established several research institutes, some with a strong focus on nuclear technologies and applied physics. The IFA (Institute

of Atomic Physics) is an important example of an initiative that has enabled the transfer of scientific knowledge to industry, especially in the field of nuclear energy. Romania had access to certain technologies from the Soviet Union and the Warsaw Pact countries, and some technologies were adapted and applied in industry. However, innovation in national research has been limited due to political isolation and technological restrictions. In the 1970s, the Ceaușescu regime adopted a policy of accelerated industrialization, which required closer collaboration between the academic and industrial sectors. High-tech factories were established, including in fields such as electronics, chemistry and mechanical engineering. However, due to Romania's growing economic isolation, these efforts often relied on imported technologies, and technology transfer was restricted. Research institutes for specific industries were established during this period, such as the National Institute for Construction Research (INCERC) and institutes for mining and natural resources. These institutions had the role of contributing to the development of new technologies and supporting industrial processes, but most operated under strict state control.

After the Revolution of 1989 and the collapse of the communist regime, Romania began a period of transition to a market economy. This led to the opening of the country to new sources of technology and know-how from the West.

During this period, universities and research institutes began to collaborate more closely with international firms and participate in European projects. Since the 2000s, Romania has adopted national policies to stimulate innovation, such as the National Strategy for Research, Development and Innovation.

These policies sought to support the creation of partnerships between academia, industry and government to accelerate the technology transfer process. Accession to the European Union in 2007 opened new opportunities for research and innovation, providing access to European funding programs such as Horizon 2020 and creating premises for better integration into international research and development networks.

The Regional Development Agencies (ADR) and the National Agency for Scientific Research and Innovation (ANCSI) are examples of institutions that have begun to support innovation and technology transfer by granting funds and creating collaborative frameworks between industry and academia. With the entry into the 21st century, technology parks and business incubators began to develop, such as *ICECHIM* (National Research and Development Institute for Chemistry and Petrochemistry), which aims to connect research with market needs and support start-ups ures based on new technologies. Technology transfer in Romania has evolved over time, from early limited collaborations between universities and industry to national innovation support policies. Research institutions and government policies have played an important role in facilitating these transfers, and Romania's integration into European structures has accelerated modernization processes and access to new technologies. However, the challenges of financing, infrastructure and effective collaboration between the private and public sectors have remained constant over time.

- **Creation of the Technology Transfer Offices (TTOs)**

The creation of the Technology Transfer Offices (TTO - Technology Transfer Offices) in Romania was an essential step for stimulating innovation and collaboration between universities and the private sector. The establishment of these offices focused on facilitating the application of knowledge and the results of scientific research in the economic and social environment, to stimulate economic development and industry competitiveness. The Innovation and Technology Transfer Infrastructure was created, evaluated, and accredited by the National Authority for Scientific Research based on Government Decision no. 406/2003. Its purpose is to support socio-economic development, stimulate innovation and technology transfer, and attract investments aimed at capitalizing on the research and development results, as well as the human resources from the national research and development system (Centrul de Transfer Tehnologic CENTI, 2011). Innovation and technology transfer are solutions for addressing economic challenges and ensuring the continuous renewal of necessary technologies by aligning Romanian research with the demands of a growing and globalized market. According to the national reglementations, the development of innovation and technology transfer infrastructure at the national, regional, and local levels involves the creation of specialized centers for scientific and technological assistance, as well as spaces for innovative businesses and organizations to develop and apply new technologies, including technology transfer centers, business incubators, and science and technology parks. The main key points about the Creation of TTOs in Romania are:

- TTOs serve as intermediaries between universities and businesses, helping to identify, protect, and commercialize intellectual property (IP) developed within academic institutions. They promote technology transfer by facilitating licensing agreements, spin-offs, and partnerships.
- The primary aim is to ensure that research results are not confined to academic circles but instead are used to develop products and services that benefit society and drive economic growth.
- The establishment of TTOs in Romania began in the early 2000s, especially after Romania's accession to the European Union in 2007, which opened access to European funding and innovation programs like Horizon 2020.
- Romanian universities such as the "Dunărea de Jos" University of Galați played a pioneering role by creating their TTOs, such as the CTT-UGAL, which formalized the process of transferring research results to the private sector
- Patent and IP Management: TTOs help researchers patent their innovations and secure intellectual property rights to protect their work
- Licensing and Commercialization: They work to license technologies to companies, helping to bring academic inventions to the marketplace.
- Industry Collaboration: TTOs facilitate collaborations between researchers and private companies, fostering joint research projects and technology development.
- Entrepreneurship Support: Some TTOs help academics launch start-ups or spin-off companies based on their research.

- Fragmentation and Limited Resources: Many early TTOs in Romania faced challenges related to limited funding, inadequate human resources, and insufficient collaboration between academia and industry.
- Complicated legal and administrative processes surrounding IP management and commercialization also hindered the efficiency of technology transfer in the early stages.
- The Romanian Government support, along with EU funding mechanisms, has been instrumental in promoting the establishment and growth of TTOs. This support includes legislative frameworks and financial programs to boost R&D and innovation efforts in Romanian universities. For example, initiatives such as the National Strategy for Research, Development, and Innovation (SNCDI) and access to Horizon Europe funds have been critical in enhancing the capabilities of TTOs in Romania.

Several Romanian universities have successfully transferred technologies to the market, particularly in fields like food engineering, IT, and renewable energy. The establishment of TTOs in Romania has been an essential step in integrating academic research into the commercial sector. Despite early challenges, these offices have evolved as vital players in the national innovation ecosystem, promoting collaboration between universities and industries and facilitating the commercialization of research. However, ongoing efforts are needed to strengthen their capacity and address systemic issues to fully capitalize on the potential of Romanian academic research for economic growth. Since the 2000's, Romania has felt a growing need to create formal mechanisms to enable the transfer of technology from higher education institutions and research institutes to the market. Accession to the European Union in 2007 intensified this process, as Romania began to participate in European research and innovation projects, such as *Horizon 2020,* which promoted technology transfer activities. Universities and research institutes were generating valuable knowledge that in many cases remained unexploited commercially. Universities, such *as* "Dunarea de Jos" University of Galati, have sought to contribute to regional development, especially in economic fields such as the naval industry, the food industry, mechanical engineering and environmental sciences. The continuous training and technological transfer department has enabled the university to attract funds from external sources, through collaborations with industry or European grants, contributing to financial sustainability. Romania has aligned itself with a global trend, in which universities have become a key pillar in stimulating innovation and entrepreneurship, through offices dedicated to technology transfer. The first TTOs in Romania were established around the 2000s, in response to the growing needs to capitalize on research results and to stimulate innovation through collaborations between academia and industry.

The example of the Continuous Training and Technological Transfer Department of the "Dunărea de Jos" University of Galati.

The department was created to provide support in two essential directions: the continuous training of human resources through non-formal education programs

and the transfer of technology from the university to companies. Its mission was to create an environment in which research results are effectively applied in industry, contributing to the economic development of the Galati region, but also of other areas.

The University of Galați, one of the most important higher education institutions in the southeast of Romania, has had a traditional role in training specialists for local industries, especially in the naval and food fields. By creating a technology transfer department, the university wanted to expand its impact through direct collaborations with companies and by supporting technology startups. DFCTT initially supported several applied research projects, particularly in food engineering and technology, areas in which the university had recognized expertise. The first wave of Technology Transfer structures in Romania, including the one within the "Dunărea de Jos" University of Galați, played an important role in facilitating collaboration between universities and industry, supporting the transfer of knowledge and technologies to the market. Although their initial impact was limited by the economic and cultural challenges of the transition period, these offices laid the foundations of an innovation ecosystem that evolved significantly in the following years, with Romania's integration into the European Union and access to research and innovation funds.

Expansion of TTOs and related organizations:

Government Decision no. 346/2023 repeals Government Decision no. 406/2003, which regulated the Methodological Norms for the establishment, operation, evaluation and accreditation of entities from the innovation and technological transfer infrastructure, as well as the way to support them.

This decision established the normative framework for the creation and operation of entities involved in innovation and technology transfer, such as science parks, business incubators, technology transfer centers or university spin-offs. On the date of entry into force of GD no. 346/2023, all provisions and norms of GD no. 406/2003 are no longer applicable, being replaced by the new legal framework established by GD no. 346/2023. The aim is to update the existing legislation on innovation and technology transfer according to the new economic and technological realities and Romania's integration into the European research and innovation space. In this context, attempts are being made to develop technology transfer structures in Romania.

Currently 48 structures are registered in the Register of Accredited Entities from the Innovation Infrastructure and Technological Transfer. These structures are recognized and accredited in accordance with the specific methodological norms approved by Government Decision no. 346/2023. Innovation and technology transfer infrastructure is a set of organizations and entities that support technology transfer and innovation in various economic, scientific and technical fields.

These entities are essential for the development of collaborations between academia, research and industry, facilitating the practical application of innovations (Ministerul Cercetării, Inovării și Digitalizării, 2024). Another system for promoting innovation activities and technology transfer is the one

administered by OSIM, the State Office for Inventions and Trademarks, respectively the Regional Centers, territorial entities that aim to promote culture and protect industrial property in the regions where they operate.
These centers play a key role in supporting innovators, entrepreneurs and researchers in the understanding and correct use of industrial property rights (patents, trademarks, industrial designs, etc.). The operation of the Regional Centers is based on collaboration agreements concluded between the State Office for Inventions and Trademarks (OSIM) and the entities that host these centers (Oficiul de Stat pentu Invenții și Mărci, 2024). Host entities can be universities, chambers of commerce or other organizations that have expertise and resources in the field of industrial property and want to support local initiatives in this field.

Through these centres, they offer:

- advice and assistance to local businesses and innovators regarding the protection of inventions, trademarks, designs and industrial models.
- promoting knowledge related to industrial property, organizing seminars, conferences and training courses.
- facilitating access to information about patents, invention databases and other useful resources for the protection of industrial property rights.

These Regional Centers contribute to awareness of the importance of intellectual property protection, being a point of contact between innovators and OSIM at the regional level.
Another national system for promoting innovation and technological transfer activities is carried out through the Regional Development Agencies (Agenția pentru Dezvoltare Regională Sud-Est, 2024). In addition to these agencies, there are regional innovation consortia, consortia made up of representatives of the public, private sector, universities and NGOs.
The coordination of the governance process of the Smart Specialization Strategy of Development Regions (SSIR/RIS3) involves a set of activities and strategic mechanisms designed to guide and support economic development based on innovation and research in Romania's regions. This process is regulated by a series of methodologies and documents issued by the Ministry of Regional Development and Public Administration (MDRAP), in particular the Methodology for the elaboration of the Framework Document for the Regional Research and Innovation Strategy for Intelligent Specialization - issued by the MDRAP on June 29, 2016. This methodology sets out the steps and criteria for the development of smart specialization strategies (RIS3) at regional level. The purpose of this strategy is to identify the priority areas of economic development and research, based on the specific competitive advantages of each region. Smart Specialization Strategies contribute to:

- increasing investments in research and development at the regional level.
- development of the innovation ecosystem by connecting local actors (universities, research centers, SMEs, administration).
- facilitating the regions' access to European funding, by aligning with the objectives of the European Union.

The implementation mechanism for Axis 1 of the Regional Operational Program 2014-2020 - issued by MDRAP on June 8, 2016. This mechanism regulated the way in which the Smart Specialization Strategy was applied through Axis 1 "Promotion of technological transfer" from the Regional Operational. Program (POR) 2014-2020. Through this program, regions are supported to implement projects that promote innovation, including the creation and development of innovation and technology transfer infrastructures, the promotion of partnerships between the private, public and research sectors, the financing of innovative projects with regional economic impact.
The governance of the RIS3 strategy involves the coordination at regional level of several stakeholders, including local authorities, universities, companies and other economic entities, to ensure their alignment with regional development priorities and European innovation and competitiveness objectives.
This process facilitates the development of regions through innovation and the identification of areas with high potential for economic growth, while encouraging collaborations between the private and public sectors.

- **Key Milestones**

According to the annual report of the rector of "Dunărea de Jos" University of Galati regarding the state of the university - 2023, among the strategic objectives pursued are the increasing the international reputation and visibility of the institution, at the regional, national and international level, in CDI-TT activities for science and society, and the development of scientific research and innovation in relation to society, the development of research directions with performance potential that can bring a competitive advantage to the university, ensuring the stimulating climate for research and innovation activities, supporting start-up initiatives, supporting joint projects with the socio- economic. An overview of patenting activity reveals the situation regarding innovation in Romania. In this regard, according to OSIM statistics, a consistent number of patent applications were registered between 2013 and 2023 (Figure 2.2).

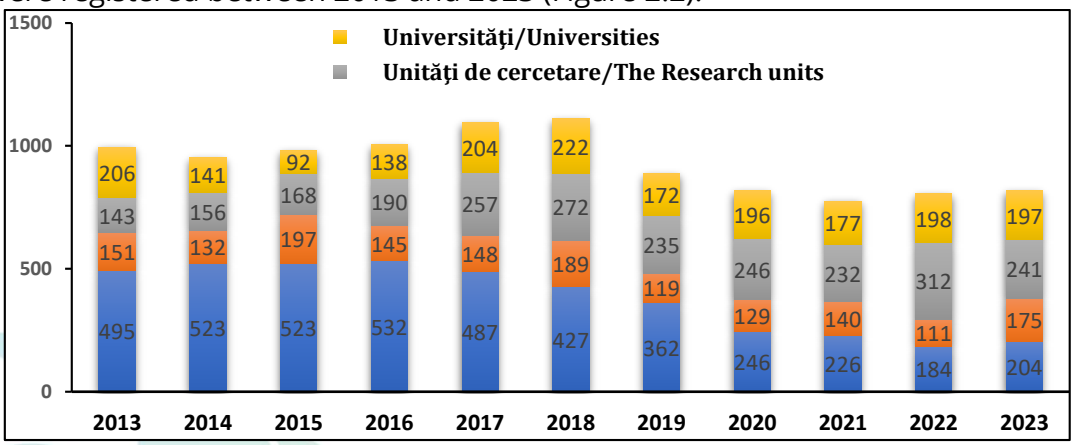

Figure 2.2 Patent applications / types of Romanian applicants 2013 – 2023
Source: Authors, by using OSIM (2024)

According to OSIM (2024) "Dunărea de Jos" University of Galati ranks 6th among all universities

with patenting activity, in the reference period 2007 – 2023 (Table 2.1).

Table 2.1. Patent applications by Universities (OSIM 2007-2023)

No. crt.	Name of the university	200	200	200	201	201	201	201	201	201	201	201	201	201	202	202	202	202	Tot
1	"Stefan the Great" Univ. Suceava	14	21	19	32	26	21	11	7	12	15	37	45	33	28	32	36	42	**671**
2	"Gheorghe Asachi" Technical Univ. Iaşi	36	68	46	130	88	46	35	42	5	19	23	35	20	29	18	13	18	**431**
3	Bucharest Polytechnic Univ	6	16	10	31	28	9	19	14	7	34	26	23	23	15	34	22	16	**333**
4	"Transylvania" Univ. Brasov	0	29	13	22	31	23	37	19	7	10	24	14	9	6	7	11	4	**266**
5	Technical univ. Cluj-napoca	6	8	8	25	29	18	14	12	10	10	12	18	21	18	10	13	6	**238**
6	**"Dunărea de Jos" University of Galati**	**10**	**3**	**9**	**16**	**13**	**2**	**2**	**5**	**6**	**5**	**12**	**18**	**16**	**10**	**13**	**9**	**11**	**160**

Source: OSIM (2024)

In this direction, at the institutional level, the Directorate for Continuous Training and Technological Transfer (DFCTT) was established, a structure that operates since the Order of the Ministry of National Education No. 25944/01.02.1999. The department was created through the European Community project JEP TEMPUS 11243-96, having as its main activity the organization of educational programs specific to continuous training and technology transfer to the academic community, the business environment, public institutions, civil society, etc.

- **Notable cases and examples:**

The last invention patent made by university students *"Procedure for obtaining a fermented vegetable product yogurt type from sprouted legumes and the product thus obtained"* was obtained on 30.07.2024, this being from the field of the food industry, a field of great tradition within the University "Dunărea de Jos" University of Galați which made the last two effective transfers by awarding a patent obtained and a patent application published in BOPI. Thus, the Invention Patent with the title "Spreadable vegetable product and method of obtaining it", resulting from the research of the team of specialists from the Faculty of Food Science and Engineering of the "Dunărea de Jos" University of Galati, was assigned to SANOVITA.

In 2017, the spreadable product made from whole bean and lentil flour won the gold medal at the International Salon of Inventions in Geneva. The team of professors and PhD students who worked on this project for more than two years was coordinated by Prof. Dr. Petre Alexe and consists of Prof. Univ. Dr. Iuliana Aprodu, head of works Dr. Eng. Livia Pătrașcu, head of works Dr. Eng. Ina Vasilean and Dr. Marian Neculau.

The patent was put up for auction in October through the Technology Transfer Center of the Department of Continuous Training and Technology Transfer (DFCTT) within the "Dunărea de Jos" University of Galați, for the sum of 60,000 RON. SANOVITA had already been producing pâté for more than two years, on a royalty basis, and even developed a diversified line, the product can be found on the shelf at the price of 3 lei in the variants: red lentil flour spreadable paste. with

pepper/hot peppers and wholemeal flour spread with tomatoes and onions/peppers and tarragon.

Figure 2.2 The spreadable product patented by Dunărea de Jos" University of Galați, and transferred to industry
Source: UDJG (2024), www.cercetare.ugal.ro

It is a great pride for our researchers and the university that a high-quality product can be found on the shelves of the most important food chains. On August 5, 2022, SC Lusta Cons SRL was awarded a patent application for a product awarded with a gold medal at the Ecotrophelia Europe competition held in Paris, France (figure 2.3).

Figure 2.3. Ecotrophelia Europe 2018 Gold Medal dor Winning Inventor Team for Whoopi Ice
Source: UDJG (2024), www.cercetare.ugal.ro

The patent application with the title: "Procedure for obtaining ice cream from concentrated whey and fruits", resulting from the research of a team from the Faculty of Food Science and Engineering, was assigned to the interested company for 25,000.00 euros.
The patent was sold in June 2023 through the CTT-UGAL Technological Transfer Center of the "Dunărea de Jos" University of Galați.

- **Institutionalization of technology transfer:**

The institutionalization of technology transfer is an essential process for ensuring the efficiency and sustainability of innovation and technology transfer activities within universities and other research organizations. This process involves the

development of well-defined structures and mechanisms to support the transition of research results to the private sector and the market. In the case of "Dunărea de Jos" University of Galati, this evolution through the Technology Transfer Center (CTT-UGAL) which functions as an entity recognized in the national network of innovation and technology transfer (ReNITT), being initially accredited in 2017 and re-accredited in 2023 (table 2.2).

Table 2.2 Chronology of TT of "Dunărea de Jos" University, Romania

Year	**Key event**	**Description**
1999	Establishment of DFCTT	Creation of the CTTTD at the "Dunărea de Jos" University in Galati.
2003	HG 406/2003	Adoption of the Government Decision on the organization of technological transfer entities.
2015	Establishment of CTT-UGAL	The Technological Transfer Center of the "Dunărea de Jos" University in Galati was established.
2017	CTT-UGAL accreditation	CTT-UGAL was accredited as an entity in the national infrastructure of innovation and TT (ReNITT).
2020	Regional Operational Program 2014-2020	Launching the technology transfer promotion program, supporting research and innovation projects.
2023	CTT-UGAL re-accreditation	CTT-UGAL has been re-accredited and ranks 42nd in ReNITT.
2023	POCIDIF (Competitiveness Operational Program - Investments in Digitization and Innovation in Phase II)	Essential program at national level in the field of RDI and digitization, aiming to support initiatives that promote innovation, efficiency and digitization in various sectors, including the cultural one.

Source: DFCTT (2024)

CTT UGAL accreditation reflects an increased level of technology transfer, aligns with national technology transfer standards. Technology transfer has become a well-structured activity, with standardized procedures for managing intellectual property rights, patenting and commercializing technologies. For example, the "Dunărea de Jos" University of Galați has a constant presence in the national patenting charts, with a significant number of patents obtained each year. The procedures for awarding patents, their bidding and collaboration with private companies, such as the patents transferred to SANOVITA and SC LUSTA CONS SRL, reflect a well-established procedural framework, aimed at facilitating efficient technological transfer. TT activities are no longer limited to the local or national level. Internationalization is reflected by participation in international events such as the International Exhibition of Inventions in Geneva and the Ecotrophelia Europe competition. Also, international collaborations provide an extensive platform for disseminating research results and concluding strategic partnerships. By accessing European funds, as was the case with a 6-million-euro project on Priority Axis 1 - Promotion of technological transfer from the Regional Operational

Program, the university demonstrates its ability to attract funding for international projects. In Romania, the normative framework and national policies played a crucial role in the institutionalization of technology transfer. Government Decision no. 346/2023 regulates the methodological rules regarding the establishment and evaluation of innovation and technology transfer entities. CTT-UGAL complies with these provisions, being accredited according to national norms. The existence of a national framework for innovation and technological transfer, in which CTT-UGAL is an active entity, indicates a government-level commitment to support and formalize technology transfer so that it is replicable and becomes a solid mechanism for economic development.
Through these processes - professionalization of staff, standardization of procedures, internationalization of activities and integration into national frameworks - technological transfer has become an institutionalized process at "Dunărea de Jos" University of Galați. It contributes to the increase of economic competitiveness and to the valorization of scientific research through the commercialization of knowledge and innovative technologies.

- **Influence of global trends**

Global trends in technology transfer have had a significant impact on the innovation and technology transfer ecosystem in Romania. These trends, such as the growth of the knowledge economy, international collaborations and the development of intellectual property (IP) management practices, have reshaped how research and innovation are integrated into the business environment and how the results are capitalized. The knowledge economy is based on the generation and use of knowledge as the main driver of economic growth. In Romania, this trend has led to an increased focus on research and development (RD) and the integration of R&D results into the private sector through technology transfer. Universities and research centers began to focus on the exploitation of research results, not just on academic production. For example, the CTT-UGAL within the "Dunărea de Jos" University of Galați, described above, was created to facilitate the integration of innovations in industry and economy. In addition, European and national innovation funds have contributed to the development of innovation infrastructure and capacities, supporting the knowledge-based economy.

- **Emergence of New Stakeholders**

The emergence of new stakeholders in the Romanian technology transfer landscape has had a significant impact on how innovation is generated, financed and implemented. New players such as venture capitalists, private equity and multinational corporations have brought both opportunities and challenges to this ecosystem. Venture capitalists have become an essential source of financing for innovative startups in Romania. They invest in companies with high growth potential, facilitating the development of new technological solutions and promoting an environment conducive to innovation. Through their financial contribution and management expertise, venture capitalists help startups develop and implement innovative technologies. These investments allow young

companies to test and bring products to market faster, contributing to a more dynamic innovation cycle. Venture capitalists bring with them extensive networks of contacts and partnerships, facilitating collaborations between startups and other relevant research and industry entities. These connections are essential for effective technology transfer and product development.

Corporations and private investors have begun to allocate considerable funds to technological research and development. These investments not only support innovation, but also enable rapid integration of research results into commercial products. Private equity frequently collaborates with universities and research centers, forming strategic partnerships that facilitate technology transfer. These partnerships enable companies to access the academic expertise and resources needed to develop new solutions. Many private companies and investors develop incubators and accelerators that provide logistical, technological and financial support to startups. These initiatives contribute to increasing the innovation capacity of the local business environment and supporting entrepreneurship. Multinational corporations bring with them expertise and advanced technologies, helping to transfer knowledge to local markets. This transfer can include not only technologies, but also good practices in innovation management. The presence of multinational corporations in Romania generates direct foreign investment flows, which contribute to the development of the research and innovation infrastructure. These investments help build a more robust ecosystem for technology transfer. By integrating into local business networks, multinationals facilitate technology transfer to SMEs and startups. This increases the ability of these entities to innovate and compete internationally. The emergence of new stakeholders has diversified the funding sources for research and development projects, reducing the dependence on public funds. This has led to better sustainability of technology transfer initiatives. The collaboration between the various entities has led to a significant acceleration of the process of marketing innovations, contributing to the increase of Romania's economic competitiveness on the global market. The involvement of venture capitalists, private investors and multinational corporations helps to align research and development activities with real market needs, thus ensuring greater relevance of the innovations developed. The involvement of new players, such as venture capitalists, private capital and multinational corporations, has transformed the technology transfer landscape in Romania. These actors contribute to a more dynamic ecosystem, stimulating innovation and economic growth through investments, strategic partnerships and technological expertise. This change not only improves the efficiency of technology transfer, but also facilitates Romania's integration into global knowledge-based economies.

2.2 Existing studies

The reference document that defines the state of the technological transfer ecosystem in Romania is *the European Innovation Scoreboard - 2024 - Country profile Romania* (European Comission, 2024). According to the cited source, Romania registered a 33.8% increase in scientific publications, placed in the top

10% most cited. This suggests a significant improvement in the quality and relevance of research carried out in the country, contributing to increasing the international visibility of the scientific community in Romania. The 12.8% increase in the percentage of foreign PhD students indicates that Romania is becoming an increasingly attractive destination for international researchers, which contributes to the diversification and competitiveness of the research environment. Despite the mentioned progress, Romania is at 37.7% of the EU average in 2024 in terms of the attractiveness of research systems. This suggests that while there are improvements, there is still a significant gap with European standards, which may affect the country's ability to attract talent and resources. A 6.5% decrease in research and development funding and support over the past eight years, particularly in the public sector, raises concerns about the long-term sustainability of research in Romania. This can lead to stagnation of innovation and progress in various fields. The 8.9% drop-in government support for business research and development suggests that government initiatives are failing to provide adequate support to stimulate innovation in the private sector. Conversely, the 10.0% increase in R&D venture capital funding can partially offset the funding shortfall. This suggests a positive trend towards attracting private investment in innovation but is based on a funding structure that may be less stable in the long term. Romania registered a significant increase of 36.9% in the field of digitization compared to 2017, which underlines the efforts to modernize the digital infrastructure and integrate digital technologies in various sectors. Despite advances in digitization, Romania faces a major challenge in terms of digital skills. The country achieves 21.3% of the EU average in terms of the proportion of the population with higher basic digital skills. This underlines the need to invest in digital education and training to support the effective use of digital technologies (European Commission, Directorate-General for Research and Innovation, 2024).
Romania has made notable progress in research and digitization, with increased quality of scientific publications and significant improvements in digital infrastructure. However, challenges related to funding, attracting talent and developing digital skills remain significant obstacles. It is essential that Romania continues to invest in research and development, support innovation in the private sector and develop the digital skills of the population to align with European standards and strengthen its international competitiveness. This is not the only reference document regarding the current situation of the technology transfer process in Romania. Thus, the National Strategy for Research, Innovation and Intelligent Specialization 2022-2027 (Ministerul Cercetării, Inovării și Digitalizării, 2024)has among its major objective's integration into regional, European and global knowledge flows - the number of research-development-innovation structures and technology transfer. At the level of each national development region, smart specialization strategies, strategic documents addressing the need and the optimal framework for developing the national

technology transfer ecosystem have been implemented and are being implemented.

3 PESTEL Analysis of the Technology Transfer Ecosystem

Introduction

The technology transfer (TT) ecosystem is essential for a nation's economic growth and job creation, as it enables academic research to be commercialized into innovative products and services. In Romania, TT is still developing, facing challenges in research funding, infrastructure, and university-industry collaboration. The economy is split between multinational-dominated sectors, like automotive, and traditional industries, such as food and textiles, where SMEs have limited innovation capacity. An exception is the ICT sector, highlighted by the rise of UiPath, Romania's first unicorn. Regional innovation performance is generally below the EU average, except in Bucharest-Ilfov and the Western region. Globally, changes in digitization, sustainability, and cooperative partnerships, as outlined by the OECD, emphasize the need for adaptable TT models that foster collaboration and sustainability to address the evolving demands of modern economies (OEDC, 2017).

3.1. Political Factors

3.1.1. Government Policies and Support Initiatives for Technology Transfer

In recent years, Romania has introduced policies to support research, development, and innovation (R&D), but their implementation remains fragmented. The National Strategy for Research, Development, and Innovation (SNCDI) 2020-2027 aims to boost research investments and foster collaboration between universities and industry (Ministry of Education and Research, 2020). However, Romania's R&D funding is among the lowest in Europe. In 2022, only 0.48% of GDP was allocated to R&D, compared to the EU average of 2% (Eurostat, 2022). This underfunding limits universities' capacity to drive innovation and attract private-sector partnerships (Eurostat, 2024). In 2023, the EU's per-person R&D budget was €275.6, with Luxembourg, Denmark, and Germany leading. Romania focuses 35.5% of its R&D budget on basic research, in public universities, leaving only 11.0% for industrial production, which may limit innovation outcomes (Eurostat (2024). Although Romania benefits from EU funds like Horizon Europe, bureaucratic inefficiencies and regional disparities hinder fund absorption highlighting the need for improved project management and administrative capacity across regions (KPMG, 2022). Some areas receive up to €394.28M, while others only €30.48M, underscoring the need for region-specific support to strengthen Romania's innovation potential.

3.1.2. Political Stability and Long-Term Government Support for Technology Transfer

Political stability is essential for Romania's technology transfer ecosystem, as R&D initiatives require long-term planning. However, frequent government changes and administrative restructuring at the Ministry of Research, Innovation, and Digitalization (MCID) have delayed funding programs and hindered public-private partnerships in technology transfer (MCID Report, 2021). The MCID should act as a catalyst for collaboration between public and private entities, supporting innovation clusters and digital hubs with tools like digitalization audits and export readiness assessments. Promoting Industry 4.0 and reviving the Sectorial Research Plan for Industry could enhance R&D in eco-design and material reuse. The National Competitiveness Strategy 2021-2027 recommends supporting technology transfer entities and digital innovation hubs to help SMEs improve innovation capacity through audits and business reviews (Ministry of Energy, 2023). Reducing administrative burdens and creating an IT platform to share mature patents from R&D institutes could further facilitate technology adoption across Romania's industrial sectors.

3.2. Economic Factors

3.2.1. General Economic Conditions and Their Impact on the Technology Transfer Ecosystem

Romania's economic conditions significantly impact its technology transfer (TT) ecosystem, with innovation capacity constrained by a focus on low-value production roles in global value chains. Although Romania's GDP per capita grew by 50% from 2015 to 2021, the country ranks low within the EU, at 26th for GDP per capita and 22nd for purchasing power parity (National Institute of Statistics, 2020) (National Institute of Statistics NIS, 2020). Economic growth between 2017 and 2019, driven by foreign investments and the IT&C sector, was disrupted by the COVID-19 pandemic, resulting in a 5% GDP contraction in 2020 (OECD, 2021). Despite challenges, the IT&C sector, contributing around 6% of GDP, continues to offer TT opportunities, particularly in automation and cybersecurity (INS, 2021) (NIS, 2021). R&D expenditure has declined over the years, peaking in 2008 at 0.42% of GDP but stabilizing at 0.15%-0.2% since 2015 (figure 3.1).

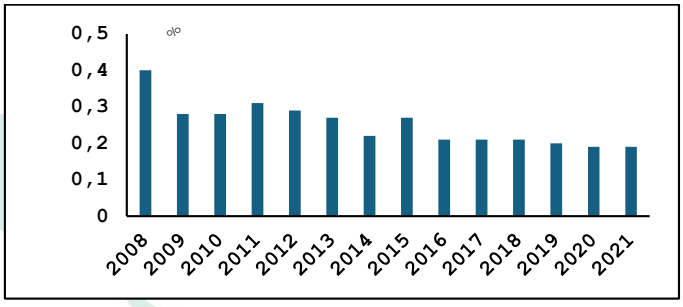

Figure 3.1 Total RDI expenditures in public sector as % GDP

Source: Authors, by using National Institute of Statistics NIS (2024)

The decreasing trend in public R&D expenditure as a percentage of GDP raises concerns about the country's commitment to fostering innovation and development in key sectors.

3.2.2. Availability of Venture Capital and Innovation Funding

Romania has a low survival rate for innovative start-ups, with few passing the five-year mark. Factors such as limited support services, financing challenges, high bureaucracy, and an unpredictable legislative environment contribute to this issue. Venture capital is essential for supporting start-ups, but Romania's market remains underdeveloped compared to Western Europe, with relatively few providers (European Investment Fund, 2022). Total venture capital investments in Romania were projected at €130 million, well below the European average, and primarily concentrated in Bucharest-Ilfov and the North-West, creating regional disparities (figure 3.2).

Notable Romanian venture capital funds include Catalyst Romania and Early Game Ventures, with typical investments ranging between $1 million and $5 million (Private Equity List, 2024). Venture capital growth is evident, particularly in the ICT sector, which has consistently attracted a large share of funding, peaking at €129.6 million in 2023. However, Romania's ability to fully absorb European innovation funds remains hindered by bureaucratic inefficiencies, underscoring the need for streamlined processes and enhanced administrative capacity to maximize these resources (European Commission, 2022).

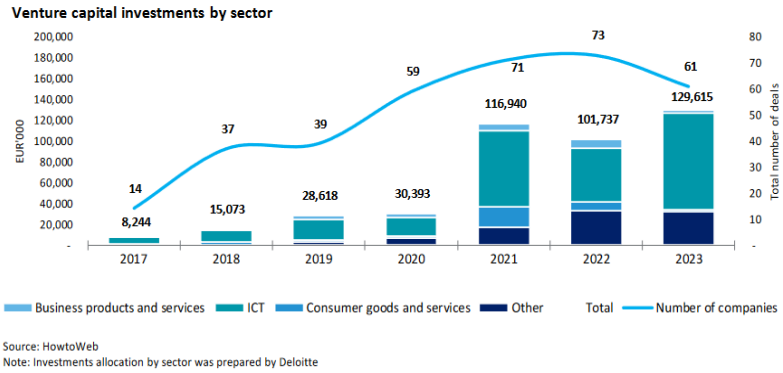

Figure 3.2 Venture capital invetsments in Romania

Source: (European Investment Fund, 2022)

3. 3. Social Factors

3.3.1. STEM Education and Its Impact on the Technology Transfer Ecosystem

A key social factor affecting technology transfer in Romania is the STEM education system. Although initiatives exist, mainly in private schools, STEM remains underdeveloped nationwide. Only 15% of Romanian graduates come from STEM fields, compared to the EU average of 25% (National Higher Education Report, 2021; Eurostat, 2021), limiting Romania's ability to innovate and commercialize technologies. Despite this gap, Romanian students perform well internationally,

ranking 15th in the 2023 Index of Excellence in STEM Education, ahead of countries with competitive education systems like Germany and Canada. Although universities are beginning to adjust curricula to align with industry needs, there is still a significant mismatch between training programs and market demands, affecting domestic innovation potential (Cârligeanu, 2024).

3.3.2. Public Attitudes Toward Disruptive Technologies

An Ipsos survey across 31 countries shows Romanians are increasingly informed and optimistic about AI, with 77% feeling they understand it and 62% excited about its potential—both above the global average (IPSOS, 2023). Romanians also show higher confidence in AI's fairness and trust companies that use it, reflecting a positive outlook on emerging technologies, especially among younger, urban, and educated demographics. However, there is hesitancy toward disruptive technologies like genetic engineering, with 58% expressing concerns about its use in agriculture, particularly in rural areas, which could impact technology adoption in traditional sectors (IPSOS, 2023).

3. 4. Technological Factors

3. 4.1. Innovation Performance and Research Infrastructure

Romania's innovation performance is among the lowest in the EU, significantly impacting its technology transfer ecosystem. According to the European Innovation Scoreboard 2023, Romania ranks last in patent applications and overall innovation (European Innovation Scoreboard, 2023). Key strengths include increased venture capital expenditures, public-private collaborations, and high-tech exports, but high non-innovation rates and low climate-related performance remain challenges (European Commission, 2023).

Romania's innovation gaps arise from factors like low tertiary education rates, minimal SME collaboration, and underfunded research infrastructure. Despite these issues, there are success stories, such as the ELI-NP laser facility in Măgurele, which attracts international research and technology transfer opportunities in nuclear physics and renewable energy (National Institute for Nuclear Physics and Engineering, 2021). Innovation trends from 2002 to 2020 show a stable enterprise count but fluctuating innovation rates, with successful innovation remaining consistently low (Figure 3.3).

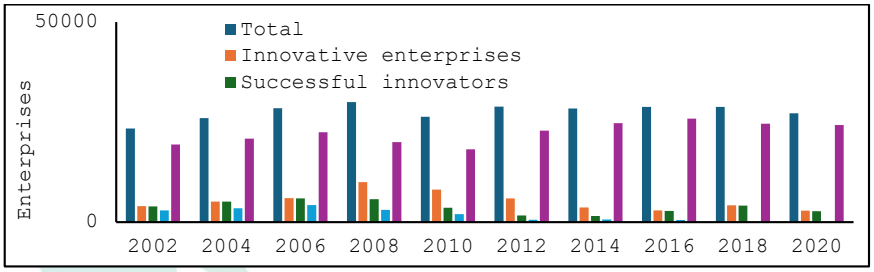

Figure 3.3 Typology of innovators in Romania

Source: Authors, by using National Institute of Statistics NIS (2024)

Romania's innovative firms represent only 10.7%, compared to an EU average of 57.1% (Bole et al., 2024). Supporting systems to enhance collaboration between academia and industry, increase funding, and develop infrastructure are essential for sustainable innovation (Figure 3.4).

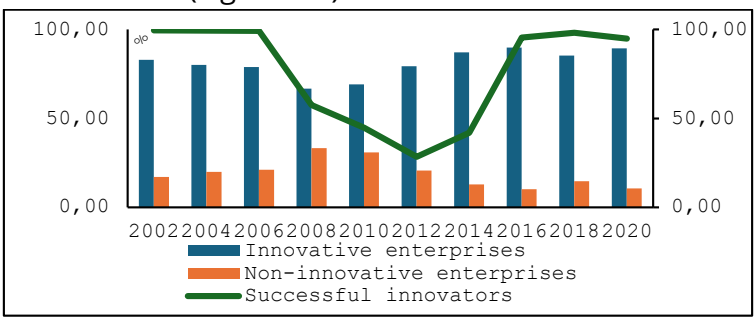

Figure 3.4 Innovative vs non innovative and success rate of innovators IN Romania

Source: Authors, by using National Institute of Statistics NIS (2024)

3. 4.2. Adoption of Emerging Technologies in Romania

Romania's IT&C sector, a key driver of economic growth, contributes about 6% to GDP and leads in adopting emerging technologies such as AI, blockchain, and IoT (NIS, 2021). National initiatives in 2021 marked progress in blockchain implementation within government systems, supporting digitalization and innovative solutions (European Commission, 2021). Despite moderate readiness for emerging technologies—ranking 45th globally in the Technology and Innovation Report (UNCTAD, 2021)—Romania's potential requires further investment and strategic integration across sectors. Research indicates that companies acquiring technology from national research bodies perform better economically, yet the technology transfer rate remains low. Licensing statistics are scarce, and many Technology Transfer Offices (TTOs) lack completed agreements, highlighting Romania's struggle with tech commercialization (Bole et al., 2024). The Community Innovation Survey shows few firms involved in IP licensing, with Romania ranking last among surveyed countries. Spin-off creation from Romanian research institutions is also minimal, as national-level data is lacking (OSIM, ReNITT, ARoTT). While commercial databases list successful alumni-founded start-ups—238 from the Bucharest University of Economic Studies, 120 from Babeș-Bolyai University, and 107 from the University of Bucharest—most are not tied to university IP, underscoring the need for stronger university-industry connections (Bole et al., 2024).

3.5. Environmental Factors

3.5.1. Green Technologies and the Transition to a Sustainable Economy

Romania, aligning with the European Green Deal, generated 25% of its electricity from renewables in 2021, emphasizing green technology transfer in renewable energy and sustainable agriculture (Ministry of Energy, 2021; European Commission, 2021). Aligned with EU norms, Romania's environmental regulations

drive sustainable technology adoption and create opportunities for circular economy solutions, particularly encouraging sustainable agriculture technology collaborations (Ministry of Agriculture and Rural Development, 2022).

3.6. Legal Factors

3. 6.1. Intellectual Property Protection (IP)

In Romania, intellectual property (IP) protection is managed by the State Office for Inventions and Trademarks (OSIM) for patents and the Romanian Copyright Office (ORDA) for copyright. OSIM's mission is to support innovation by granting industrial property titles and promoting IP protection domestically and internationally. In 2022, Romania registered only 58 patent applications with the EPO, far below the European average, indicating low IP engagement (EPO, 2022; Figure 3.5).

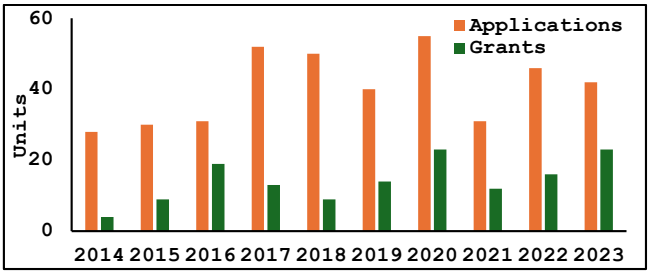

Figure 3.6 Romanian patents and grants registration at EPO 2014-2023

Source: EPO (2024)

Key legislation includes the Patents Law (Law No. 64/1991) and related regulations, as well as other laws addressing designs, trademarks, and scientific research infrastructure (OSIM). Romanian IP laws are generally aligned with EU standards and the European Patent Convention, but they often lack clarity and practical guidance, leading to interpretative challenges and low patent awareness. Ministerial Order No. 28 (2021) provides limited guidance on spin-off formation, which may hinder innovation. The European Patent Office's 2024 updates aim to streamline Romanian patent processes, aligning them with EU goals. Patent applications have varied, peaking in 2020 with 55 applications, and a significant portion of patents relates to computer technology, biotechnology, and medical technology (EPO, 2024). Romanian universities often hesitate to commercialize innovations due to weak IP protection, and limited patent filings highlight the need for a stronger IP infrastructure to facilitate technology transfer and encourage domestic innovation.

3.6.2. Legislative Framework for Technology Transfer

The legislative framework for technology transfer in Romania is fragmented and lacks coherence, making it difficult to foster collaborations between academia and the private sector. Although there are regulations governing technology licensing and commercialization, they are not clear enough and do not provide consistent support for public-private partnerships (Ministry of Research, 2020). Furthermore, bureaucratic processes associated with obtaining funding for technology transfer

projects are complicated and inconsistent, discouraging companies from participating in university collaboration initiatives. To improve this framework, a legislative reform is needed to simplify procedures and encourage innovation through a clear and transparent framework for licensing and IP protection.

4 Key players in the technology transfer ecosystem in Romania

4.1 Profile of major institutions

Provide profiles of leading universities, their research centers and TTOs, as well as other public and/or private initiatives/institutions that support the TT ecosystem, including a catalog of services offered and funding mechanisms. In the technology transfer (TT) ecosystem in Romania, the main actors are universities, research centers and technology transfer offices (TTOs), as well as several public and private institutions that support innovation. These entities collaborate to facilitate the transfer of research results from academia and research to industry and the market. Technology transfer involves the creation of intellectual property (IP) by a research organization. The structure of the research sector in Romania is distinct from other European countries and is notably fragmented. Depending on the counting method used, Romania's RDI (Research, Development, and Innovation) system consists of around 263 public RDI organizations, alongside a significantly larger number of private entities such as incubators, accelerators, and science parks. The public institutions include 56 public universities, 46 national research and development institutes, and 65 research centers and institutes that operate under the Romanian Academy, which enjoys a high degree of autonomy from the government. Additionally, there are approximately 34 private universities that are state-accredited, but typically receive little to no state funding, with some conducting minimal or no research activities. A larger number of private RDI organizations also exist, but these are not explored in detail in the research made by Bole et al. (2024).

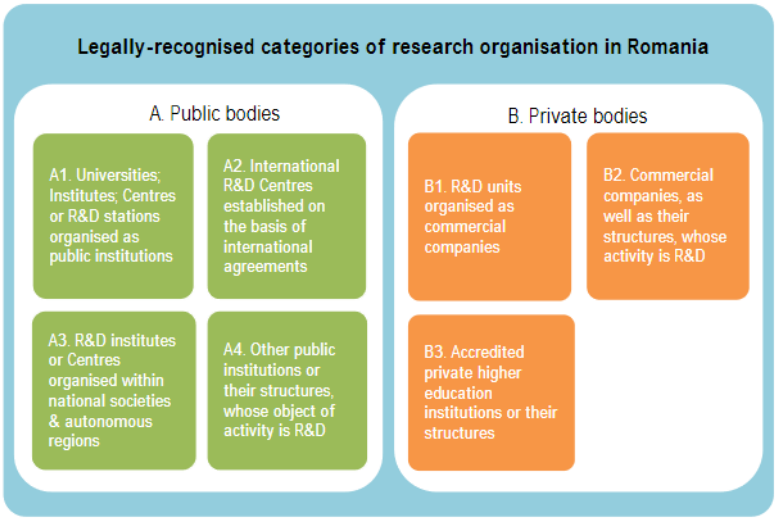

Figure 4.1 Categories of Research Organisation in Romania
Source: Bole et al. (2024).

To be classified as a research entity under the law, at least 80% of the institution's revenue must come from research activities. However, the law is flexible enough to allow universities and national institutes to interpret "research" as covering various types of activities. Romanian law recognizes several distinct categories of research entities (figure 4.1). Additionally, within the classification of public entities, there is a specific designation for "R&D&I entities of national interest." This category includes national R&D&I institutes, accredited higher education institutions, research institutes, centers or stations of the Romanian Academy, as well as research and development institutes or centers organized within national companies, state-owned enterprises, and autonomous regions of national significance. Additionally, within the classification of public entities, there is a specific designation for "R&D&I entities of national interest." This category includes national R&D&I institutes, accredited higher education institutions, research institutes, centers or stations of the Romanian Academy, as well as research and development institutes or centers organized within national companies, state-owned enterprises, and autonomous regions of national significance. Within the research sector, a substantial portion of research activities is carried out by research institutes rather than universities, as reflected in the higher number of patent filings by these institutes. The national research and development institutes were created to consolidate scientific and technological expertise in key areas of national interest. Although publicly funded, these institutes possess legal and financial autonomy.

Most, but not all, of the national research institutes are overseen by the Ministry of Research, Innovation, and Digitalization and are funded through the "Nucleus" program, which typically covers 45% to 70% of each institute's budget. The remaining institutes are coordinated by the Ministries of Defense, Ministry of Agriculture and Rural development, or Ministry of Health. These national institutes are allowed also to conduct commercial and production activities based on their own regulations. However, few have their own technology transfer offices.

The Romanian Academy operates independently from the National Institutes and Universities, with its own distinct funding mechanisms. It oversees a network of 60 institutes and research centers, encompassing various scientific disciplines, as well as artistic and literary fields. In 2001, two of these institutes were acknowledged by the European Community as centers of excellence. None of the institutes affiliated with the Romanian Academy have formal Technology Transfer Offices (TTOs) in place.

4.1.1 Top Universities and their Technology Transfer Offices (TTOs)

There are several higher education institutions in Romania. Public universities, which are state-owned and operated, date back to the 1860s. Private universities, except for a few theological seminaries, were established after 1989.

Currently, there are 56 public universities, and 34 private universities accredited by the Romanian Agency for Quality Assurance in Higher Education.
Research in public universities has been quite limited, with responsibility divided among different ministries:

- The Ministry of Research, Innovation, and Digitalization (MCID) does not have direct responsibility for university research but provides funding through various instruments available to university researchers.
- The Ministry of Education oversees most, but not all, public universities, and until a few years ago had little or no responsibility for research. Civil public universities are listed under Government Decision (H.G.) no. 403/2021 (with subsequent amendments and additions).

The Ministry of Research, Innovation, and Digitalization (MCID) provides funding opportunities without direct control over university research, while the Ministry of Education supervises most public universities but has minimal research oversight
.
Not all Universities and research institutes have TTOs. Where these do exist, these are almost all run simply as a department within the university administration, rather than as a separate legal entity as is common in many other countries.

- **National Research and Development Institutes**

Romania's research landscape includes 46 national research and development institutes (NRDIs) and 65 research centers under the Romanian Academy, which together play a substantial role in the country's research output, often exceeding that of universities. These institutes were established to consolidate scientific expertise in key areas of national interest. Despite being publicly funded, they have legal and financial autonomy, allowing them to undertake commercial and production activities based on their regulations. However, a significant limitation is that few of these institutes have dedicated Technology Transfer Offices (TTOs), which restricts their ability to directly commercialize research outcomes.
The Nucleus Program primarily funds NRDIs, covering between 45% and 70% of each institute's budget. Most NRDIs are managed by the Ministry of Research, Innovation, and Digitalization (MCID), though several are overseen by other ministries, such as those responsible for defense, agriculture, and health.
In contrast, the **Romanian Academy** operates independently from NRDIs and universities, managing 60 institutes and research centers across various scientific disciplines and the arts. None of these Romanian Academy institutes have formal TTOs, which further limits commercialization efforts. This structure presents unique challenges for Romania's research commercialization and highlights the need for strategic enhancements in technology transfer infrastructure across NRDIs and academic institutions.

- **National Institute for Research and Development in Mechatronics and Measurement Techniques**: This institute hosts a Technology Transfer Center (CTT - CRTTC), focusing on mechatronics, fine mechanics, optics, and medical instruments. Located in Pantelimon, this center serves as a bridge between

academic research and the medical equipment industry, offering expertise in high-precision engineering fields

- **National Research and Development Institute for Industrial Ecology (ECOIND):** ECOIND's CTT specializes in environmental protection, climate change solutions, and biotechnologies. This center enables the development of innovative pollution mitigation and clean energy technologies, helping industries align with environmental standards.
- **National Chemical-Pharmaceutical Research-Development Institute (ICCF Bucharest):** The CTT-ICCF supports research commercialization in pharmaceuticals, biopreparations, agriculture, and cosmetics. The center aids in translating laboratory discoveries into market-ready products, particularly in bio-based and cosmetic applications
- **INMA (National Research-Development Institute for Machinery and Installations for Agriculture and the Food Industry)**: Located in Bucharest, the INMA-ITA incubator facilitates the transfer of technologies related to precision agriculture, bioenergy, and intelligent systems. This incubator focuses on innovations that support sustainable agriculture and food production.

- **Technology Transfer in Romanian Universities**

Romanian universities have increasingly recognized the importance of Technology Transfer Offices (TTOs) in bridging the gap between academic research and industry applications. These centers have been pivotal in transforming theoretical research into practical solutions that benefit the economy and society. Following Romania's EU accession in 2007, many universities established TTOs to align with European standards and capitalize on funding and innovation networks. This has led to the development of significant regional innovation hubs, particularly in technical and applied sciences. Notable examples include the Technical University of Cluj-Napoca (UTCN), Polytechnic University of Bucharest (UPB), and Ovidius University of Constanța (UOC), among others.

- **Technical University of Cluj-Napoca (UTCN)**

UTCN has established the Center for Technology and Knowledge Transfer (CTTC), focusing on critical fields such as bioeconomy, energy, eco-nanotechnologies, ICT, and advanced materials. This center connects UTCN's research capabilities with regional industry needs, emphasizing practical applications that contribute to industrial growth in Northern Romania. By actively collaborating within industry clusters, UTCN has become a vital innovation hub, supporting projects that address contemporary challenges like climate change and materials science.

- **Polytechnic University of Bucharest (UPB)**

UPB's TTO has been instrumental in advancing research commercialization, especially in engineering, ICT, and renewable energy. UPB's TTO facilitates patenting processes, industry collaborations, and IP commercialization. These efforts are bolstered by EU-funded programs that support sustainable

partnerships and innovation in areas such as smart city development and advanced manufacturing. As a central player in Romania's capital, UPB's TTO is strategically positioned to connect with numerous tech firms, enhancing the university's influence in the country's technology landscape.

- **Ovidius University of Constanța (UOC)**

UOC has also established a Center for Technology Transfer (CTT), which operates under its Research and Innovation Department. This center aims to foster entrepreneurial activities among faculty, students, and alumni and to support the transfer of knowledge and research findings to regional beneficiaries, enhancing their competitiveness. The center provides technical and scientific support to innovative startups, along with consultancy in management, finance, marketing, e-commerce, and legal matters. UOC's TTO is dedicated to regional development, especially by assisting small and medium enterprises with access to research-based solutions.

- **University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca (USAMV Cluj-Napoca)**

The Technology Transfer Office (TTO) at USAMV Cluj-Napoca plays a critical role in promoting sustainable development by transforming academic research outcomes into commercially viable products and services. This TTO focuses on bridging the gap between research in agricultural sciences, veterinary medicine, and industry needs. By supporting projects that advance eco-friendly practices and sustainable agricultural solutions, USAMV's TTO has positioned itself as an essential player in Romania's bioeconomy. The office also facilitates partnerships with agricultural enterprises and helps researchers navigate the commercialization process, offering support in areas such as patenting, licensing, and business model development.

- **Gheorghe Asachi Technical University of Iași (TUIASI)**

The Technology Transfer Center at Gheorghe Asachi Technical University of Iași (TUIASI) aims to drive technological innovation and economic growth in Eastern Romania. This center is dedicated to fostering collaboration between the academic community and the business sector. TUIASI's TTO assists in the development and transfer of new technologies, particularly in engineering and applied sciences, and supports both faculty and student researchers in bringing their innovations to the market. By providing consulting, funding access, and training, TUIASI's TTO actively contributes to regional development and supports the university's mission of producing research with high industrial relevance.

- **University of Agricultural Sciences and Veterinary Medicine of Banat (USAMVBT):** This university's CTT concentrates on the agri-food sector, facilitating partnerships that bring academic research to agricultural and food processing industries. USAMVBT's CTT plays a key role in advancing sustainable agricultural practices in Romania.

Challenges and Opportunities for Technology Transfer in Romania

While Romanian universities have made notable strides in establishing TTOs, challenges remain. Limited commercialization infrastructure and resources often constrain these centers' effectiveness. However, the increasing alignment with European programs like Horizon 2020, alongside government initiatives, provides new opportunities for growth. Each university's TTO is increasingly seen as essential in transforming Romania's academic research into a driver of regional and national economic progress. These initiatives reflect Romanian universities' commitment to leveraging research for economic development, enhancing competitiveness, and fostering innovation through effective collaborations with the industrial sector.

- **Technological transfer at "Dunărea de Jos" University of Galati, Romania**

"Dunărea de Jos" University of Galați (hereinafter referred to as the University) is a state higher education institution, established in 1974, which operates based on Decree no. 105/1974, having a University Charter whose provisions comply with national legislation and with the principles of the European Higher Education Area, known to members of the university community.

Figure 4.1 Dunărea de Jos" University of Galati. Rectorate Building
Source: UDJG (2024),

In 1991, by the Order of the Minister, the current name of the institution was established: "Dunărea de Jos" University of Galați.
The history of higher education in Galati includes the following stages:

- 1948: establishment of the Land Improvement Institute.
- 1951: establishment of the Mechanical - Naval Institute.
- 1953: the merger of the Mechano-Naval Institute with the Agronomist Institute and the Institute of Fishing and Fishing Culture (transferred from other university centers) and the creation of the Technical Institute in Galati.
- 1954: establishment of the Faculty of Mechanics by HCM no. January 14/9, 1954, previously operating the Galati Technical Institute (HCM no. 2727/1953), the successor of the Mechanical-Naval Institute in Galati (HCM no. 1050/October 2, 1951);

- 1955: merger of the Technical Institute with the Institute of Food Industries from Bucharest.
- 1957: the transformation of the Technical Institute into the Polytechnic Institute.
- 1959: the establishment of the Pedagogical Institute and the move to Iasi of the Land Improvement Institute.
- 1974: the establishment of the University of Galati through the union of the Polytechnic Institute with the Pedagogical Institute (Decree of the State Council of March 20, 1974).
- 1991: The University of Galati becomes the "Dunărea de Jos" University of Galați of Galati (Government Decision of January 4, 1991). In the structure of the mentioned institutes, unique study programs in the country functioned: shipbuilding, naval and port exploitation, food industry, fish farming technology, refrigeration technology, a fact that made it an important conception process, in terms of the development of educational plans and programs, courses, laboratory equipment, etc., currently used in other university centers of the country, to be entirely the work of the specialized teaching staff from the Galați higher education.

Currently, University has 15 faculties and prepares students for bachelor's, master's and doctorate studies in various fields (technical, humanistic, economic, sanitary, artistic). University organizes the second cycle of two-year studies for the graduates of the first cycle. Within the "Dunărea de Jos" University of Galați, doctoral studies are carried out in 4 Doctoral Schools, 19 doctoral fields, under the coordination of 129 PhD supervisors. The mission and objectives of the University distinguish it within the national and international education system, consolidating its position as the most important university in South-Eastern Romania.

University undertakes the mission of generating and transferring knowledge to society, not only through education, but also through scientific research, development, innovation and technology transfer activities. Through these efforts, the university contributes to the advancement of knowledge and its application in practice, having a significant impact on social and economic progress. This commitment highlights its essential role in community development and improving the quality of life, both locally and internationally. According to the Rector's Annual Report on the State of the University - 2023, [3]among the strategic objectives pursued by our institution are: Increasing the international reputation and visibility of the University at the regional, national and international level, in the CDI-TT activities for science and society. The development of scientific research and innovation in relation to society, the development of research directions with performance potential that can bring a competitive advantage to the university, ensuring a stimulating climate for research and innovation activities, supporting start-up initiatives, supporting joint projects with the social environment economic.

[3]The rector's annual report on the state of the university - available at https://www.ugal.ro/files/hotarari/hs/2024/HS_106_2024_Anexa-Raport_anual_Rector-2023.pdf

Technology Transfer Offices

Technology Transfer Offices (TTOs), also referred to as Technology Transfer Entities (TTEs), are organizations that facilitate the technology transfer process, often acting as intermediaries between inventors and the later-stage developers or users of a technology. Their responsibilities may include formalizing and protecting intellectual property (IP), marketing IP, negotiating IP licenses and material transfer agreements, tracking and distributing royalties, and creating spin-offs. In many research organizations outside Romania, TTOs also handle broader functions such as industry engagement, collaborative research, business development, and entrepreneurship support.

In Romania, there are significantly fewer TTOs (aprox. 75) compared to the 263 public R&D&I organizations at the time of this writing. As a result, most universities and research institutions do not have their own in-house TTOs, and if they engage in technology transfer, they rely on third-party services. Where in-house TTOs do exist, they are often small, typically consisting of only 1-2 staff members. In contrast, across Europe, TTOs tend to be larger: 24% of them employ between 5-10 full-time equivalent (FTE) staff, and 29% employ 10-25 FTEs (ASTP, 2022). One exception to the limited number of TT experts in Romania is the Technology Transfer Center Polytech (Gheorghe Asachi Technical University of Iasi), which employs around 20 staff members. However, these employees work not only on knowledge transfer and incubation but also on various project management and implementation tasks. Another example of a well-established institutional technology transfer structure is the CTT ECOIND Technology Transfer Center, which operates as a department within the National Research and Development Institute for Industrial Ecology ECOIND. This center includes experts specialized in IP protection, as well as specialists in IP valorization and marketing.

The study conducted by Bole et al. (2024) shows that most TTO entities have filed patent applications, but only one or two have successfully concluded licensing agreements or formed spin-offs. National statistics on these matters are not available. Many of the TTOs interviewed in the research were either undergoing reorganization or in the process of adopting new or revised policies, strategies, or rules regarding technology transfer and intellectual property protection. These changes directly impact the functioning of TTOs, from the recognition of commercialization as a strategic priority by top management to the implementation of clear rules for IP protection and management at the operational level (Bole et al., 2024).

Many university-based TTOs do not have separate legal personalities, functioning instead as internal departments, with contractual matters often handled by the administrative offices of the parent institution. Public policy regarding TTOs is managed by the Ministry of Research, Innovation, and Digitalisation, which sets the requirements and conditions for TTO accreditation. In Romania, the governance of TTOs is shaped both by the policies of their parent institutions and by the rules, methodologies, and reporting requirements imposed by the Ministry of Research, Innovation, and Digitalisation. At present, Romanian law divides Technology Transfer Offices into two categories: accredited and unaccredited. Accreditation is based on Government Decision (GD) No. 406 (2003), recently

updated through Decision 346/2023, which specifies processes for the establishment, operation, evaluation, and accreditation of entities concerned with innovation and tech transfer infrastructure, as well as the way of supporting them. The law also recognises four official sub-types of TTO: Centres for Technology Transfer (CTT); Offices for Industry Liaison (OLI) as per the 2023 Decision; Technology and business incubators (ITA) and Technological Information Centres (CIT). Accredited TTOs are monitored, being required to provide specific performance indicators as well as data concerning the existence and follow-up of measures in their own strategies. From 2004 until 2007, TTOs were financed by National Programme for "Development of innovation and technology transfer infrastructure - INFRATECH", established by GD 128/2004. However, when the INFRATECH programme ended, there was no direct replacement, meaning that there was effectively no specific allocation of funding to TTOs for more than 10 years. TTOs are connected and interact through dedicated networks and associations. At the regional level within Romania, there are a few networks, although TTOs may participate in the various partnerships which have been created between Regional Development Agencies, TTOs, Universities, R&D National Institutes, innovative companies, aiming to support Regional Innovation & Smart Specialisation Strategies (RIS3).

ReNITT: At the national level, some coordination is provided by ReNITT - the National Network for Innovation and Technology Transfer. This is an initiative of the Ministry of Research and Innovation which aims, on the one hand, to increase the visibility of R&D units and the exploitation of their research results and, on the other hand, to improve the competitiveness of SMEs through knowledge and technology transfer. ReNITT encompasses about 50 specific organisations, including technology transfer centres (CTTs), technology information centres (CITs), technology and business incubators (ITAs), science and technology parks. ReNITT has no legal personality. ReNITT also created ARoTT (below). ReNITT is not a financing agency and not able to allow financing, but only facilitate participation in research projects.

ARoTT is the Romanian Association of Technology Transfer and Innovation. Unlike ReNITT, ARoTT has a legal personality, which means that it can create international partnerships and participate in international projects. It is run as a non-governmental and non-profit organisation and serves as a professional organisation for tech transfer and innovation units. It aims to promote TTOs and innovative businesses with Romania, as well as the professional interests of its members, including through training. ARoTT participates in international events and projects, creates its own national or regional events, and helps in the transfer of good practices. ARoTT members are also frequently members of EEN and DTC Networks (below).

The Danube Transfer Centres Network (DTC) is an international network spanning the Danube Region, dedicated to fostering innovation and knowledge transfer between academia and the economic environment. With 13 members, present in 9 countries, the DTC Network can aid and support to organisations seeking to improve their competitiveness and international dimension. The

services which the DTC provides include technology transfer, intellectual property management, management of innovation projects and value proposition consultancy. Romania has 4 hubs, in Craiova, Bucharest, Iasi, Cluj-Napoca, with each hub having regional partners.

Enterprise Europe Network (EEN) is an initiative of the European Commission. It is the largest European network that supports businesses to innovate and grow in other markets and supports firms through specialised services provided by experts from over 600 centres with specific expertise, located in each region of the European Union. Within Romania there are also four regional networks: BisNetTransilvania (with centres at: Alba Iulia, Sfantu Gheorghe, Cluj-Napoca, Brasov, Covasna); ERBSN (which covers Bacau, Botosani, Braila, Buzau, Constanta, Galati, Iasi, Neamt, Tulcea, Vaslui and Bucharest) and RO_BOOST (with centres at Timisoara and Craiova). In addition, there are three other networks of relevance, although it is unclear that they are much used by Romanian TTOs.

The Alliance of Technology Transfer Professionals (ATTP) aims to promote and maintain global standards in knowledge and technology transfer. It maintains the Registered Technology Transfer Professional (RTTP) accreditation. There are no Romanian organisations which were ATTP members, or individuals who were RTTP-qualified.

The Association of University Technology Managers (AUTM) is a US-based organisation, originally founded as the Society of University Patent Administrators. Its mission is to promote tech transfer from universities. Although US-centric, the Association is expanding globally and welcomes members from across the world.

Accelerators & Incubators for TT

Acording to article mentioned, there are at least 20 accelerators in Romania, together with six incubators and 33 coworking spaces (although, as is often the case in other countries, boundaries between organisational types are sometimes blurred). It is unclear whether any of these entities are actively engaged in technology transfer. Some of them combine TTO functions with incubation activities such as the TT and Business Incubator Centre ”Gh. Asachi” University of Iasi.

"Dunărea de Jos" University of Galați is one of the few Romanian universities that has its own technology transfer center, established within the Department of Continuous Training and Technology Transfer.

At the institutional level, the Directorate for Continuous Training and Technological Transfer (DFCTT) was established, a structure that operates based on the Order of the Ministry of National Education no. 25944/01.02.1999. The department was created through the European Community project JEP TEMPUS 11243-96, having as its main activity the organization of educational programs specific to continuous training and technology transfer to the academic community, the business environment, public institutions, civil society, etc (figure 4.2).

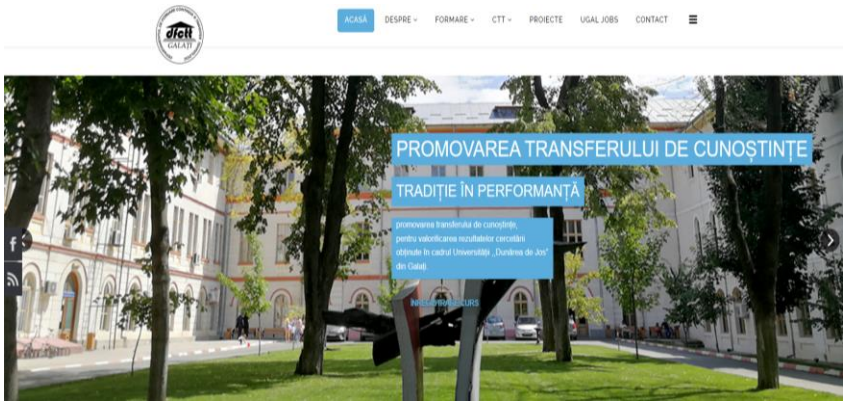

Figure 4.2 Department of Continuous Training and Technological Transfer
Source: UDJG (2024), www.dfctt.ugal.ro.

Promoting the importance of technological transfer in contemporary society is a mission of utmost importance at the institutional level. In this sense, several events with this theme are regularly organized (figure 4.3). The CTT-UGAL was established within the University, according to the Decision of the Board of Directors of the "Dunărea de Jos" University of Galați no. 14/2.04.2015 and was accredited as an entity in the national infrastructure of innovation and technological transfer ReNITT through OMCI no. 722/27.11.2017.

Figure 4.3 Institutional Technology Transfer Fairs
Source: UDJG (2024), www.dfctt.ugal.ro

The CTT-UGAL was re-accredited through OMCID no. 20482/13.04.2023 being found at position 42 in ReNITT of the Ministry of Research, Innovation and Digitalization *https://www.mcid.gov.ro/sistemul-de-cercetare/infrastructuri-de-cercetare/entitati-de-inovere -and-technological-transfer / .*

Type of technology transfer entity according to HG 406/2003
The established and accredited entity is - **TECHNOLOGY TRANSFER CENTER: CTT-UGAL**

CTT - UGAL is established and operates in accordance with the provisions of the Higher Education Law no. 199/2023, of Government Decision no. 346/2023 on the approval of the Methodological Norms regarding the establishment, operation, evaluation and accreditation of entities from the innovation and technology transfer infrastructure, as well as the way of supporting them. The accreditation areas for which the UGAL Technology Transfer Center offers technology transfer services are Bioeconomy, Environment and Eco-Technologies, Energy and Mobility.

The vision regarding the role of a technological transfer infrastructure

CTT-UGAL is an entity without legal personality, which operates within the University, under the conditions imposed by art. 9 of the Methodological Norms regarding the establishment, operation, evaluation and accreditation of entities from the innovation and technological transfer infrastructure, as well as the method of their support, was approved by GD no. 346/2023. CTT-UGAL is established to capitalize on the research-development-innovation results obtained by the University, thus contributing to the intensification and stimulation of CDI activity within the institution and to the development of partnerships in the field of technological transfer in the national and international economic environment. Through the entity, scientific achievements, intellectual property rights and institutional expertise in the field of research and development are promoted, with the aim of increasing economic competitiveness and the degree of innovation, redesign and transfer of advanced technologies and facilitating the institution's access to international funding sources. Within the framework of CTT-UGAL, the realization of goods and services and their valorization through contracts with the private sector is aimed at respecting the legislation in force and the internal regulations of the University The implementation of the technology transfer vision through the CTT - UGAL Technology Transfer Center is based on a series of competitive advantages that can facilitate the success of this process. The most important advantages that can be listed are:

A) High-quality academic expertise and resources through:

- Advanced research - University has a solid track record in research and innovation, with teams of qualified researchers in various technical and scientific fields. This enables the development of innovative, relevant and applicable solutions in the industry.
- Access to scientific and technological resources - CTT benefits from state-of-the-art laboratory equipment and testing and prototyping facilities essential for the development and validation of new technologies.

B) Infrastructure dedicated to technology transfer:

- Modern facilities - CTT has a specific infrastructure for technology transfer, a body of experts from each faculty belonging to University, coworking spaces and innovation centers, which support startups and partner companies in the development of processes and commercialization of technologies.
- Intellectual property support - CTT contribute on the protection of intellectual property, helping to manage patents and copyrights, which ensures that innovations are properly exploited.

C) Access to finance and support for innovation:

- Through CTT-UGAL, it can access national and international funds for research and innovation, thus facilitating the implementation of technological transfer projects.
- Support for entrepreneurship CTT-UGAL provides support for entrepreneurial initiatives, helping researchers and inventors turn innovative ideas into viable businesses.

D) Adaptability and market orientation:

- CTT-UGAL can adapt the results of academic research to the specific requirements of the market, thus ensuring the relevance and usefulness of the transferred technologies.
- By working closely with industry, CTT ensures that the solutions developed meet real market requirements, which increases the likelihood of commercial success.

E) Capacity for training and professional development:

- CTT-UGAL with the support of the Department of Continuing Education and Technology Transfer, offers continuing education and training programs for industry personnel, helping to disseminate knowledge and increase skills in the use of new technologies.
- "Dunărea de Jos" University of Galați attracts and trains specialists in various technical fields, preparing them for involvement in technological transfer projects.

The place of the organization in the regional / national / sectoral value chain

At the regional level, research, development and innovation activity is characterized by the following elements: a valuable tradition in scientific activity and in obtaining notable results in the field of research; the high adaptability of the CDI system, which maintains a relatively stable annual level of activity and results, despite the difficulties it faces; process of (gradual) increase in the degree of visibility and international involvement of the scientific and technical community; the problem of insufficient funding from public funds, the funds allocated to research from the state budget continue to be far below the required level; the research-development infrastructure in which quite a lot was invested, without government support, which led to the gap between the existing endowments in institutes and university laboratories (equipment, devices), compared to the requirements according to current standards; the problem of human resources: in recent years, two unfavorable trends have been registered in terms of research personnel: the reduction of the number and the increase of the average age. At the local and regional level, technical and scientific support is provided for the transfer of technology, from which commercial companies and national SMEs can benefit, to maintain their competitiveness in the competitive business environment, specific to the market economy.

A priority of the activity of the CTT - UGAL Technology Transfer Center is the exploitation of intellectual property, demonstrating the role of innovative structures in promoting economic development through scientific research. "Dunărea de Jos" University from Galaţi is the holder of numerous research patents, which can find applicability in the business environment (http://www.ugal.ro/cercetare/valorificare-si-diseminare-rezultate-cdi/brevete).

Transposing the research results from the University in support of national and regional economic development is a primary objective, direction in which the CTT-UGAL will provide the necessary consulting support for the introduction of the latest technological discoveries in the production processes of on the market. The staff assigned to CTT - UGAL has higher education, being specialized in the areas of interest for the center's activity (engineering sciences, economic sciences, legal and administrative sciences). In the business environment, partnerships with the local business community will be prioritized, without neglecting the national or European market.

The financing of the research activity carried out by CTT UGAL is carried out on the basis of contracts, with funds from the state budget (through contracts concluded with the relevant ministry through the contracting authority UEFISCDI) or from other sources (contracts with the industrial environment), with financing from the beneficiaries of resources, concluded on the basis of orders), technological transfer contracts with the business environment, the organization of professional training programs, with fees, intended for business partners.

Accessing the financing opportunities offered by the projects developed with European funds is a priority of CTT UGL. The center won the financing conditions for a project on Priority Axis 1 – Promotion of technological transfer, Regional Operational Program 2014-2020, in the amount of 6,000,000 euros, which aims to develop a regional technology transfer center in a building of historical heritage University. Due to the high rate of co-financing, specific to the funding direction, against the backdrop of the COVID 19 pandemic, the university could not contract the project. At the national and sectoral level, CTT-UGAL represents one of the growth pillars of CDI-TT activity, the special results of the activity being included in the National Strategy for Research, Innovation and Intelligent Specialization 2022-2027, being obtained in the field of *food, bioeconomy, resources natural resources, biodiversity, agriculture and environment* within the following main sub-areas:

- increasing the relevance of forests in reducing pollution
- agriculture's contribution to climate neutrality and resilience
- circular bioeconomy
- water resource management and sustainable development of fisheries and aquaculture
- food and nutritional security
- sustainable, balanced and inclusive development of urban, rural and coastal areas
- innovative governance models that encourage sustainability and resilience.

The results on this field/subfield are demonstrated by the patenting activity in the field and the licensing or assignment of the obtained patents.

Among the services already functional at the entity level, we can mention:

- Consultancy for Innovation and Technological Transfer.
- Research and development innovation services.
- Training and professional development.
- Access to financing and consulting for submitting financing applications.
- Support for their patenting and exploitation.

Enumeration of the mechanisms (services/tools) already functional at the organization level to support enterprises in acquiring new knowledge/technologies, innovation support/consultancy services:

- Identifying and analyzing the specific needs of businesses in order to propose appropriate technological solutions (contracts with third parties);
- Development of customized innovation strategies for companies, including planning of research and development activities (within various projects that involved partnerships with the private sector).
- Collaborating with companies to develop new products, processes or services based on advanced research.
- Providing access to UGAL laboratories and equipment for testing, prototype development and technology validation.
- Support in the process of patenting and protection of intellectual property rights, including legal advice.
- Organization of continuous training programs for the company's employees, focused on new technologies and trends in the industry.

Enumeration of new mechanisms (services/tools) envisaged at the organization level to facilitate the commercialization of knowledge/technologies

- Developing and perpetuating solid partnerships with the private sector.
- Pursuing and accessing financing related to the areas of accreditation with the involvement of profile companies to increase the degree of financial absorption in the region.
- Cyclical organization of events specific to technology transfer with the involvement of relevant authorities at national level, local public administration and representatives of sectoral committees, ADRSE, AM etc.

Enumeration of new mechanisms (services/tools) envisaged at the organization level to support enterprises in acquiring new knowledge/technologies, innovation support/consultancy services.

"Dunărea de Jos" University of Galați through the Technology Transfer Center is considering the development and implementation of new mechanisms, services and tools to support businesses in acquiring new knowledge, technologies and to provide support/consultancy in innovation having considered the development of structures such as:

- Creating an online platform that facilitates the connection between researchers and enterprises, providing access to technologies, patents and expertise.
- Development of a publicly accessible database containing information on innovative solutions available for transfer.
- Creating open innovation spaces where companies, researchers and students can collaborate to develop new technologies and products.
- Support businesses in adopting advanced digital technologies such as artificial intelligence, big data and IoT.
- Support for the development of sustainable solutions, optimizing the use of resources and reducing the carbon footprint.

- Initiating accelerator programs that provide mentorship, resources and funding to innovative startups in various fields.
- Development of specialized incubators in sectors such as bioeconomy, renewable energy or urban mobility.
- Creation of centers dedicated to the development and transfer of advanced technologies, such as nanotechnology, biotechnology or green technologies.
- Initiatives to bring together international and local experts to develop innovative projects.
- The development of financing schemes adapted to the specific needs of enterprises, which include grants, capital investments and support for the development of innovation projects.
- Implementation of vouchers (with access to any available funding) for innovation to cover costs associated with consultancy services and technology transfer.
- Support services for enterprises wishing to internationalize their technologies, including assistance in participating in international fairs and cross-border partnerships.
- Mechanisms that facilitate technology transfer between enterprises and international partners.
- Creating services to monitor global technology trends and identify innovation opportunities for business.
- Providing reports and market analysis to support companies in making strategic innovation decisions.
- Developing educational campaigns and programs to raise awareness among businesses of the benefits of innovation.
- Organizing events to stimulate creativity and rapidly develop innovative solutions involving students, researchers and businesses.

The implementation of these new mechanisms will strengthen CTT-UGAL's ability to support enterprises in the innovation process and help them become more competitive at the national and international level.

Operations:

- **Basic services** : Evaluation of the commercial potential of IPR resulting from research and development activities; Support and consultancy provided for the protection and commercialization of IPR; Support and consultancy provided for the preparation of strategies and business plans to justify the creation of companies; Identifying and managing IPRs arising from research activities and providing ongoing professional advisory/training services to develop the entrepreneurial skills of the research community and university students.
- **Funding mechanisms**: Sources of funding for TT activities (eg government grants, industry partnerships, internal university funds). In its activities, CTT is supported by the support staff and the body of specialized technical experts made up of representatives appointed by the faculties, whose mission is to identify the results of research and IPR carried out/in progress at the faculty level, through their analysis. from the perspective of the need for their

protection in relation to their commercial potential. Funding has multiple sources, own funds and national/international projects.

- **Policies/Strategies about TT**: The results of the UGAL CTT analyses, carried out in collaboration with the body of specialized technical experts.
- **Internal processes and practices**: Support activities for the protection of intellectual property rights, analysis, management of intellectual property titles.
- **Key achievements**: Outstanding commercial technologies, successful spin-offs or partnerships - two patents assigned to the external environment, in industrial-scale production.
- **Values and impact:** statistical data on the number of patents filed, licenses issued, startups launched, and the overall economic impact generated by TTO.
  - **Number of Invention Disclosures:** The total number of invention disclosures submitted by researchers or professors to the TTO. Total number of patent applications 2017 - 2023 89 patent applications filed and published.
  - **IP portfolio size**: total number of active patents /other forms of IP managed by the TTO: 13 patents (**2022** - 4 patents; **2023** - 3 patents; **2024** - 6 patents.)
  - **Number of licenses executed**: total number of technology licenses signed with companies or startups - 2 patents awarded.
  - **Number of startups/spin-offs**: 0

4.1.2 Prominent Research Centers

For each institution you can provide the following information (when and if applicable). PPs may add additional information on additional topics they consider significant. The research and technology transfer infrastructure of the "Dunărea de Jos" University of Galați can be accessed on the research website at cercetare.ugal.ro. Currently, the university operates 35 research units and one technology transfer center, being available at https://cercetare.ugal.ro (figure 4.4).

Figure 4.4 Reasearch infrastructure at University

Source: *Source: UDJG (2024), www.dfctt.ugal.ro*

Research Center: An integrated center for research, expertise and technology transfer in the food industry (BioAliment-TehnIA)

- **Brief description**: Background and areas of expertise
- **Technology Transfer Office (TTO)**:
  - **Short description:** The research center was established in 2001, with the name "Biotechnologies in the Food Industry and Aquaculture (BIAA), within the Faculty of Food Science and Engineering, Department of Science, Food Engineering, Biotechnologies and Aquaculture. This center has been accredited. at the national level, in 2001, and re-accredited in 2004, based on Recognition Certificate no. 33/CC-B of 11V-2004 issued by CNCSIS Bucharest.
- **Operations:**
  - **Core services**: intellectual property management, patent filing, licensing, industrial partnerships and startup incubation. The BioAliment-TehnIA Center offers a diversified range of consultancy, expertise and technological transfer services for the socio-economic environment, in the fields of: food science, food engineering and applied biotechnologies, ensuring the guarantee of professionalism and scientific and applied skills through modern means. infrastructure and highly qualified human resources (http://ugal.ro/files/cercetare/2017/0_Catalog__BioAliment-TehnIA.pdf).
  - **Funding mechanisms:** Sources of funding for TT activities (eg government grants, industry partnerships, internal university funds). Projects:
  - *727580 – Safe Food through Changed Consumer Behavior: Effective Tools and Products, Communication Strategies, Education and Food Safety Policy that Reduce the Health Burden of Foodborne Illness (SafeConsumE).*
  - *ERA-IB-16-014 – Development of a new industrial process for safe, sustainable and high-quality food using biotechnology and cybernetic approach (SAFEFOOD). (Ctr. no: 15/2017).*
  - *62/2018 – Multifunctional products obtained from colostrum fermented with kefir granules (3-Biotic+).*
  - *29BM /2018 - Valorization of bioactive compounds and microbial resources from wine grapes; COST action CA15215 – Innovative approaches in whole male pork production*
  - **TT Policies/Strategies**: (eg, including IP management and commercialization/ strategies, spin-off creation, etc.) Active concerns in providing technology solutions based on partnerships.
  - **Internal processes and practices**: (e.g. innovative approaches, technology licensing processes, technology marketing strategies, terms and forms of service delivery, industrial collaborations and partnerships and evaluation and monitoring of technology transfer projects,

internationalization of TT activities, etc.). Sustained activity in the field was realized through many patents.

- **Key achievements**: Outstanding commercialized technologies, successful spin-offs or partnerships. Outstanding commercialized technologies, successful spin-offs or partnerships. Two patents assigned.
- **Values and impact:** statistical data on the number of patents filed, licenses issued, startups launched, and the overall economic impact generated by TTO.
- **Number of invention disclosures**: The total number of invention disclosures submitted by researchers or professors to the TTO.
- **IP portfolio size**: total number of active patents and other forms of intellectual property managed by TTO - 7 patents
- **Number of licenses executed**: total number of technology licenses signed with companies or startups - 2 contracts
- **Number of startups/spin-offs**: the number of new startups or spin-off companies formed based on the technologies developed at the institution. (N/A)

Research Center B

European Center of Excellence for the Environment (ECEE)

- **Brief description:** Background and areas of expertise
- **Short description:**

The European Center of Excellence for the Environment was established in 1999 as an Intermediate Department, being financially supported by the Dutch government (Matra Program RO/97/04). In 2001, because of a rigorous competition organized by the European Union (PHARE Program RO 9706.01.02), the Intermediate Department of the "Dunarea de Jos" University in Galati was classified as a European Center of Excellence for the Environment. (ECEE), thus becoming the only Romanian Center classified as such by the European Union. In addition to the activities normally carried out in a university department (education, research, information), ECEE mainly aims to:

- participation in national and international networks together with other academic and non-academic institutions concerned with issues of sustainable development from the environmental point of view.
- active participation in research and development projects financed by national and international programs
- joining local and national administration partners in organizing projects regarding environmental protection, sustainable development and the influence of environmental factors on the health of the population.
- the training of specialists in various fields related to the environment.
- providing consultancy and expertise in a wide range of issues that are directly or indirectly related to the environment.
- organizing exchanges of students and teaching staff financially supported by international institutions that grant scholarships or by ECEE partners in international projects that grant funds from their budgets.

- the organization of national and international conferences, seminars and workshops on issues directly or indirectly related to environmental monitoring, its quality and management.
- In addition to its own staff, ECEE collaborates with all the faculties and departments of the University in a wide range of fields, thus contributing to the development of multidisciplinary networks making the most of the University's staff.

- **Operations:**

Basic services:

- 1. **Environmental Science and Engineering, Earth Sciences: Environmental and Resource Management, Ecology, Environmental Change, Geophysics, Climatology:** water quality monitoring, water pollution, soil science, soil pollution, ecology, biogeochemistry, environmental chemistry; meteorology, atmospheric physics and chemistry, air pollution (air quality), climatology and climate variability, ozone, upper atmospheric ionosphere, geomagnetism, space science, interplanetary environment, satellite earth observations; numerical simulations; numerical and statistical analysis; environmental engineering in the field of applied statistics and biostatistics, biomathematics.
- 2. **Functional techniques of food and medicinal products for micro and nanoencapsulation.**
- 3. **Extraction and synthesis of organic compounds by conventional methods** and belonging to green chemistry (biocatalysts, ultrasound, microwaves): separation and purification of organic compounds; physico-chemical and biochemical analysis of natural and synthetic organic compounds; molecular interactions, organic compounds, bimolecular.
- 4. **Funding mechanisms:** Sources of funding for TT activities government grants, industrial partnerships, internal university funds.
- 5. **TT Policies/Strategies:** Active concerns in providing technology solutions based on partnerships.

Internal processes and practices: sustained activity in the field embodied by many patents.

- **Key achievements:** outstanding commercial technologies, successful spin-offs or partnerships. Two patents assigned.
- **Values and impact: statistical data on the number of patents filed, licenses issued, startups launched, and the overall economic impact generated by TTO.**
- **Number of Invention Disclosures**: The total number of invention disclosures submitted by researchers or professors to the TTO.
- **IP portfolio size**: 4
- **Number of licenses executed**: 0
- **Number of startups/spin-offs**: 0

- **Research Center C Center for Mechanics and Tribology of the Superficial Layer (MTSS)**

Technology Transfer Office (TTO):

Brief description : The Mechanics and Tribology of the Superficial Layer research center - MTSS - (https://www.mtss.ugal.ro/objective-ro.html) was established in 2004 (Decision 44/22.01.2004 of the "Danube University Down"). The field of research is included in Engineering Sciences, Mechanical Engineering.

Operations:

Core Services:

- Generation of interdisciplinary knowledge and applicable solutions in mechanics and tribology.
- Developing the interest of public and industrial organizations in mechanics and tribology
- Designing new and sustainable solutions, including new materials, coatings, lubrication solutions, to increase the durability and reliability of engineering systems
- Simulation and Modeling in Mechanics and Tribology
- Evaluation by testing of mechanical and tribological characteristics of materials, especially polymer composites and lubricants, including impact evaluation.
- Development of standardization application
- Participation in postgraduate education and training of research engineers in the field of mechanics and tribology
- Optimizing design solutions through interdisciplinary research, re-engineering and diagnostics
- Dissemination of the results of research, design, testing and diagnostics in the field of mechanics and tribology in scientific events and in specialized journals and books.

Funding mechanisms: Sources of funding for TT activities (eg government grants, industry partnerships, internal university funds). Internal funds, PhD funds, projects and sponsors.

TT Policies/Strategies: (eg, including IP management and commercialization strategies, spin-off creation, etc.) Active concerns in providing technology solutions based on partnerships.

Internal processes and practices: (e.g. innovative approaches, technology licensing processes, technology marketing strategies, terms and forms of service delivery, industrial collaborations and partnerships and evaluation and monitoring of technology transfer projects, internationalization of TT activities, etc.).

The development of a research center in an entrepreneurial university, with the aim of integrating scientific research into the economic and social environment.

The transfer of knowledge and experience in the economic and social environment, the development of research projects with interested partners, providing researchers with a high level of competence to design sustainable solutions.

- **Key achievements:** Outstanding commercialized technologies, successful spin-offs or partnerships. Outstanding commercialized technologies, successful spin-offs or partnerships. In 2021, 36 ISI papers were published, 24 BDI indexed papers, and 35 papers were presented at international conferences.

- **Values and impact:** statistical data on the number of patents filed, licenses issued, startups launched, and the overall economic impact generated by TTO.
- Number of invention disclosures**: NA**
- IP portfolio size**: NA**
- Number of executed licenses**: NA**
- Number of startups/spin-offs**: (NA)**

Center D - Scientific research center "Romanian Center for Modeling Recirculating Aquaculture Systems - MoRAS"

Short description: "Romanian Center for Modeling Recirculating Aquaculture Systems - MoRAS" from the "Dunărea de Jos" University of Galați in Galaţi (UDJG), is an academic research unit, without legal personality, organized within the "Dunărea de Jos" University of Galați in Galaţi, the Faculty of Science and Food Engineering, created to concentrate professional experience and of professional experience. of the efforts of the scientific community in the university, for carrying out research, development and innovation in the field of activities. The MoRAS Center was established because of the implementation of the project POSCCE 622/11.03.2014 conf. HS. 136 of July 24, 2015 (*ROF approved by HS Senate Decision no. 54/April 27, 2017*).

The main mission of the MoRAS Center is to promote fundamental and high-performance applied research in the field of aquaculture of recirculating systems, by stimulating collaboration, the exchange of ideas and experience accumulated in this field by the academic community, within the "Dunărea de Jos" University of Galați. MoRAS declares itself open to scientific collaboration between all specialized units in the country and abroad based on bilateral agreements or within national and/or international programs. MoRAS proposes that, depending on opportunities, it supports the implementation, through technological transfer, of recirculating aquaculture systems and intensive aquaculture technologies, developed within it, at the level of economic and industrial units.

The objectives of MoRAS are:

- Promoting an activity supported by fundamental and applied research in the field of aquaculture of recirculating systems, aligned with the European requirements and exigencies, in collaboration with similar research groups from the country and abroad;
- Increasing the performance, transferability and visibility of research - development - innovation (CDI) activities in the field of aquaculture for a sustainable development, with the aim of raising the level of competitiveness and the integration achieved in the European area of scientific research.
- Development and expansion of the offer of advanced research, consulting and research services - innovation to the economic environment, in the field of aquaculture, increasing the competitiveness of scientific research and the economic/industrial environment. Ensuring a competitive environment for

scientific research and education through and for research, at the level of European standards, for training and attracting highly qualified human resources, capable of developing advanced research activities within UDJG, in other CD entities, as well as in the economic environment.

- Approaching new topics in the field of aquaculture to stimulate the development of the offer of fast, efficient and quality research services to the economic units interested, thus increasing the attractiveness of the institution for the realization of strategic partnerships.
- Involvement of students, master's and doctoral students, together with teaching staff and researchers with concerns in the field, in the activities carried out within the center.
- Organization of scientific events (symposiums, conferences, congresses) and editing of newsletters, magazines and books related to the field of aquaculture of recirculating aquaculture systems.
- Supporting the participation of MoRAS center members in scientific events, seminars, colloquiums, fairs and exhibitions related to the objectives of the MoRAS center. Including the activities of the MoRAS center in the national and European circuit of scientific values through collaboration with other research centers in the country and abroad and the affiliation of the center to national and European research networks.
- Stimulating and supporting project and grant proposals at national and international level.
- Sensitization of the economic and business environment to support the activities of the MoRAS center to implement the technologies developed within MoRAS, on an industrial scale, through informational and technological transfer to some SMEs.

Core Services: The MORAS Center offers a diversified range of consultancy, expertise and technological transfer services for the socio-economic environment (http://ugal.ro/files/cercetare/2017/0_Catalog_MoRAS.pdf), as follows:

1. Laboratory services: Water quality analyses; Biochemical analyzes (meat, fodder); Microbiological analyzes (water and fish); Evaluation of the health status of the fish by analyzing the metabolic blood profile (blood count, biochemical tests, oxidative stress evaluation); Control of the physiological state of fish health (parasitological analyses);
2. Training / professional development services in the field of aquaculture;
3. Consultancy services in the field of aquaculture;
4. Research, development and innovation services;
5. Services for drawing up studies/documentation in aquaculture;
6. Research and experimental development services in the field of aquaculture.

Research Center E - INPOLDE - Laboratories from the RO-UA-MD international interdisciplinary network created within the European project MIS ETC 1676

Short description : The research unit INPOLDE - Laboratories from the international interdisciplinary network RO-UA-MD created within the European

project MIS ETC 1676 was created in 2014 within the European project MIS ETC 1676, financed from ENPI funds through the Joint Operational Program Romania-Ukraine-Republic of Moldova " *Cross-border interdisciplinary cooperation for the prevention of natural disasters and mitigation of environmental pollution in the Lower Danube Euroregion"* (http://www.inpolde.ugal.ro/), implemented between 19.12.2013-31.12.2015, beneficiary "Dunarea de Jos" University " from Galati (UDJG), operating within the Department of Chemistry, Physics and Environment, Faculty of Sciences and Environment. According to HS no. 46 of 16.02.2018 was proposed for institutional accreditation and as a research unit of excellence.

The infrastructure of the INPOLDE laboratories is connected with the research equipment owned by partner institutions in the MIS ETC 1676 project from the Republic of Moldova and Ukraine (Institute of Zoology, Academy of Sciences of Moldova; Institute of Geology and Seismology, Academy of Sciences of Moldova; Scientific Research Institution " Ukrainian Scientific Center of Ecology of Sea" (SRI UkrSCES)), being found for joint interdisciplinary research in the field of environmental protection and ecotechnologies. The UC **INPOLDE** website is: http://erris.gov.ro/INPOLDE--Infrastructure (INPOLDE - Infrastructure for Environmental Interdisciplinary Research in Lower Danube Euroregion).

Correspondence of INPOLDE's CDI activity with the fields of intelligent specialization for the 2014-2020 strategic cycle: Energy, Environment and Climate Change, and Eco-Nano-Technologies and Advanced Materials.

Core Services : The INDPOLE Center offers a diversified range of consultancy, expertise and technology transfer services (http://ugal.ro/files/cercetare/2017/0_Catalog_INPOLDE.pdf) for the socio-economic environment, in the fields of:

- Assessment of indoor air radon and thoron activities and residential exposure;
- Assessment of ambient gamma radiation doses.
- Evaluation of the physico-chemical parameters of deep waters;
- Determination of concentrations of toxic chemical elements in biological, food and environmental samples.
- Environmental consultancy services.
- External evaluation of environmental projects.
- Training in the field of the environment - investigative methods in environmental monitoring.

Projects:

1. **Research Project 2017 JINR-Romania no. 80,** Investigation of advanced functional materials using atomic and nuclear analytical techniques and imaging microscopy, Topic no. 03-4-1128-2017/2019, Investigations of Neutron Nuclear Interactions and Neutron Properties, Protocol No. 4613-4-17/19, Director Romania: Ene Antoaneta.
2. **Research Project 2017 Jinr-Romania no. 81**, Applied research on air and soil pollution with toxic elements using nuclear and related analytical techniques, Topic no. 03-4-1128-2017/2019, Investigations of Neutron Nuclear Interactions and Properties of the Neutron, Protocols No. 4619-4-17/19,4613-4-17/19,4610-4-

17/19, Leaders from Romania: Stihi Claudia (Project Director, Valahia University of Targoviste), Ene Antoaneta (Co-director, UDJ Galati) , Dan-Gabriel Ghita (Co-director, IFIN-HH Magurele).

3. **JINR-Romania Research Scholarship no. 21/2018**, Development of the laboratory infrastructure for applications of nuclear and magnetic techniques regarding the characterization of agricultural soils and the content of potentially toxic elements, Topic no. 03-4-1128-2017/2019, Director Romania: Ene Antoaneta.

4. **Project Black Sea Basin Joint Operational Program 2014-2020**, code BSB27, Black Sea Basin Interdisciplinary Cooperation Network for sustainable joint monitoring of migration of environmental toxins, improved assessment of ecological status and human health impact of harmful substances and prevention of exposure public (MONITOX), Project Manager Ene Antoaneta (implementation period: 30 months; 20.09.2018-19.09.2021).

5. **Project Joint Operational Program Black Sea Basin 2014-2020**, code BSB165, Creation of an innovative cross-border monitoring system of the transformations of Black Sea fluvial ecosystems under the impact of hydropower development and climate change (HydroEcoNex), Project Coordinator Ene Antoaneta (UDJG) (period of implementation: 30 months; September 2018-February 2021).

Research Center F - Integrated Energy Conversion Systems and Advanced Control of Complex Processes (SICECAPC)

Brief description : The institutionalized research center Integrated Energy Conversion Systems and Advanced Management of Complex Processes (SICECAPC) was established in 2013, following the restructuring of the centers accredited by the National Council for Scientific Research in Higher Education (CNCSIS): "Systems of Advanced Automatic Management of Processes" - through certificate no. 35/CC-C-2001 and "Computerized Electromechanical Systems in the Naval Field" (SEIDN) through certificate 142/CC-C-2002.

SICECAPC develops interdisciplinary research activities in the fields of intelligent specialization (SNCDI 2014-2020), as follows:

- Energy, Environment and Climate Change.
- Information and Communication Technologies, space and security;
- Innovative materials, processes and products (services/micro-production).

Basic services:

The SICECAPC Center offers consultancy, expertise and technological transfer services for the socio-economic environment (http://ugal.ro/files/cercetare/2017/0_Catalog_SICECAPC1.pdf), as follows:

- Drawing up energy efficiency development programs for localities with over 5,000 inhabitants (according to the provisions of Law no. 121/2014 amended by Law no. 160/2016 on energy efficiency);
- Studies on the choice and implementation of electric drive systems with high energy performance.
- Studies on the choice and sizing of regenerative electric drive systems.
- Design, installation and commissioning of programmable logic (PLC) systems for controlling electrical actions.
- Electric actions and intelligent static converters.

- Studies regarding the modernization of industrial facilities to reduce electricity consumption.
- Studies regarding the optimization of energy consumption in companies/enterprises.
- Design and realization of optimal electric drive systems.
- Studies on the quality of electricity in voltage networks, solving problems related to the quality of electricity.
- The design and realization of active power filters of the parallel type for increasing the quality of electricity and compensating the reactive power.
- The design and realization of static power converters, to increase the quality of electricity.
- Studies on renewable energy sources of electricity. Integration and operation of electricity sources, based on renewable energy in industrial equipment, in electrical networks.
- The design and realization of static power converters, for the integration and operation of electricity sources based on renewable energy in electrical grids.
- Defectoscopy and predictive and preventive maintenance of alternating current electric machines.
- Integrated energy conversion systems and advanced control of complex processes.

Research Center G - Interdisciplinary Research Center in the field of eco-nano Technologies and Innovative materials (CC-ITI)

Brief description: The Interdisciplinary Research Center in the field of eco-nano Technologies and Innovative Materials (CC-ITI) from the "Dunărea de Jos" University of Galați, is an academic research unit organized within the "Dunărea de Jos" University of Galați. CC-ITI which was established in 2021 through the union of the Center of Interfaces – Tribocorrosion and Electrochemical Systems (CC-ITES), the Center for Nanostructure and Functional Materials (CNMF) and the Center for Materials and Environment Quality (CMM), for conducting high-performance scientific research in the field of nano and microstructured science with advanced applications and the field of environmental protection.

CC-ITI develops interdisciplinary research activities in areas of intelligent specialization (SNCDI 2021-2027), as follows:

- Eco-nanotechnologies and advanced materials.
- Energy, environment and climate change.

The application center is a training platform for young specialists (pupils, students, master's students, doctoral students and teaching staff) in the above-mentioned areas of specialization.

The research carried out, and ongoing, is directed towards priority areas such as advanced materials (nanomaterials, biomaterials, composite materials, etc.) and environmental protection (characterization and treatment of environmental factors - water, air, soil, sustainable development through the utilization of by-products and waste). , etc.).

In the CDI activity of CC-ITI, the following main object is targeted:

- The promotion of a supported fundamental and applied research activity aligned with European requirements and exigencies, in collaboration with the similar research collective from the country and abroad.
- Promoting the interdisciplinary role in obtaining and developing innovative technologies for environmental protection and the creation of nano and microstructured materials with advanced applications.
- Involvement of students, masters and doctoral students alongside teaching staff and researchers with concerns in the field.
- Involvement of students and teachers in information/promotional activities with possibilities to specialize in leading scientific and technological fields.
- The creation and development of a multidisciplinary database and the connection of CC-ITI to national and international profile networks.
- Organization of scientific events (symposiums, conferences, congresses) and editing of newsletters, magazines and books related to the CC-ITI field.
- Supporting the participation of CC-ITI members in scientific events, seminars, colloquiums, fairs and exhibitions related to CC-ITI objectives.
- The inclusion of CC-ITI activity in the national and European circuit of scientific values through collaboration with other research centers in the country and abroad and the affiliation of the center to national and European research networks.
- Stimulating and supporting project and grant proposals at national and international level.
- Sensitization of the economic environment to support CC-ITI activity in order to implement the innovative technologies developed within CC-ITI, on an industrial scale, through international dissemination and technological transfer to some SMEs.
- Reorientation of some SMEs productive activities in the field of materials with the advanced application.

Basic services:

- Consulting services, expertise, technical assistance and technological parameters for the controlled formation of aluminum oxide protective films on aluminum and other aluminum.
- Consultancy services, expertise, technical assistance and technological parameters for the formation of nanoporous thin films of titanium and other titanium oxides with biomedical applications (implants);
- Consultancy, expertise, technical assistance and corrosion resistance of materials to evaluate the construction of systems operating in the marine environment.
- Consulting services, expertise, technical assistance and resistance to corrosion degradation of assessment materials in water systems from purification, transportation, treatment and storage.
- Consulting services, expertise, technical assistance and resistance to corrosion degradation of evaluation materials in various industrial and food systems.
- Consulting services, expertise, technical assistance and in-vitro assessment of resistance to corrosion and biocorrosion degradation of biomaterials used in implants and treatments.

- Consulting services, expertise, technical assistance and in-vitro evaluation of resistance to degradation by corrosion and biocorrosion of biomaterials used in human implants and of metal surfaces in medical equipment.
- Consulting services, expertise, technical assistance and evaluation of the free energy of the surfaces of materials and solid protective layers (hydrophilic, hydrophobic);
- Consulting services, expertise, technical assistance and evaluation of solution properties: density, pH, conductivity, salinity.
- Consulting services, expertise, technical assistance and preparation of solutions and electrolytes with well-defined concentrations.
- Consulting services, expertise, technical assistance in the preparation and evaluation of the effectiveness of corrosion inhibitors for various environments of use
- Consulting services, expertise, technical assistance and technological parameters for electrochemical deposition: metals, alloys, hybrids, nanocomposites, micro and nanostructured.

Research Center H Technological Engineering Research Center in Machine Construction (ITCM)

Short description:

The ITCM Center has been operating since 2004, within the Faculty of Engineering, Department of Manufacturing Engineering. Research, Development and Innovation (CDI) activities within the ITCM center fall within the field of Engineering Sciences/Branch of Sciences – Mechanical Engineering, Mechatronics, Industrial Engineering and Management, in correspondence with the priority areas of intelligent specialization for the 2014-2020 cycle, Eco-nanotechnologies and advanced materials and Information and communication technology, space and security.

In this context, the CDI activities in which the ITCM center is involved have in mind

- identifying and solving real problems in the Romanian industry, to evolve and align with EU norms in the field of mechanical processing.
- providing expertise in the field of machine construction, production systems and quality assurance in the industrial fields of competence.
- the creation and implementation of new technologies and products, useful to a developed society.

developing partnerships with research centers of excellence in Europe, the USA and Japan.

Basic services:

ITCM offers consultancy, expertise and services in the fields of assisted design (CAD, CAM, CAE) of technologies and processing equipment, the study of the machinability of materials through cutting and through plastic deformation at the reception, control of processing processes, optimization of technologies and the operation of equipment. The main services aim at:

- Identification, management and optimization of the manufacturing process by cutting and by plastic deformation at the reception of materials.
- Research on materials processing by cutting and by cold plastic deformation.

- Research on virtual processing of industrial processes and products.
- Research on tool profiling to equalize the energy load of multiple cutters.
- Applications of machining eco-technologies.
- Predictive and experimental reliability.
- The dynamics of the machine tool torque – cutting process. Early detection of regenerative instability in machining processes.
- Finite element modeling of physical processes with applications in mechanical technologies and medicine.
- Modeling technological processes through dimensionality reduction techniques.
- The development of economic models for managing the processing processes, based on the evolution of the market.
- Automation of manufacturing processes, using programmable automatic equipment.
- Research on simulation of technological processes in flexible manufacturing systems.
- Research on adaptive-intelligent predictive control of machining processes.
- Generation of digitized surfaces by wrapping.
- Modeling of cutting generation processes under the condition of representing tools and blanks in discrete form by point clouds.
- The development of graphic methods in the process of profiling generating tools by deployment.
- The design and realization of mechatronic systems used in the simulation of technological processes.
- Implementation of quality management in product development, development of new technologies and management of industrial flows.

Research Center "Modelling and Simulation Laboratory (SMlab)"

Brief description: The Modeling and Simulation Laboratory (SMlab) carries out interdisciplinary research, development and innovation (CDI) activities in the fields of Industrial Engineering/Informatics applied in Industrial Engineering/ICT, Space and Security and Mathematics and Natural Sciences, with specific themes in imaging medical and image processing, as well as numerical and statistical analysis. At the same time, SMlab activities correspond to the directions of the field of intelligent specialization INFORMATION AND COMMUNICATION TECHNOLOGIES, SPACE AND SECURITY. SMLab provides a multi-disciplinary research group with extensive experience in international research projects and advanced facilities (development environment for numerical computation and statistical analysis).

Core services: The SMlab laboratory offers consultancy, expertise and technology transfer services for the socio-economic environment, as follows:

- CAD (Computer Aided Diagnostic) algorithms: algorithms that ensure the management and processing of specific data and information provided by the analysis of medical images.
- Consultancy in the field of digital signal and image processing, digital filtering, signal processing algorithms, numerical methods, sensors.
- Training in the fields of digital signal processing, digital filtering, mathematical methods of signal processing, applied statistics.
- Processing complex medical images for detailed analysis.

J. Intelligent Systems and Information Technology Research Center (SITI)

Brief description: The Intelligent Systems and Information Technology research center (SITI) has been operating within the Faculty of Automation, Computers, Electrical and Electronics Engineering, Department of Computers and Information Technology since 2007. The activity of this center falls within the field of intelligent specialization Information Technology and communications, space and security. The SITI Research Center is focused on the study and research of Artificial Intelligence systems, technologies and applications. Current research sub-directions are directed towards topics on intelligent systems for education, research and technical creativity and topics on Data Mining and machine learning, Soft Computing applied in intelligent systems. The mission of the SITI center is to promote high-performing applied and fundamental research in the field of Computers and Information Technology, by stimulating collaboration, the exchange of ideas and the valorization of the experience of all University specialists, while also contributing to the formation and stimulation of fundamental and applied research related to the cycles. of studies (bachelor's, master's and doctorate).

Core services: The SITI Center offers consultancy, expertise and technological transfer services for the socio-economic environment, in the fields of:

Research and design intelligent IT systems:

- Opportunity/feasibility studies of the intelligent IT System.
- Design/Evaluation of System Knowledge Representation.
- Design/Evaluation of Intelligent System Knowledge Processing Techniques.

Research and design of Big Data systems:

- Opportunity/feasibility studies of applying Big Data techniques to the solving problem.
- Data Collection and Preprocessing Design/Evaluation.
- Design/Evaluation of intelligent Big Data processing techniques.
- Evaluation of the results obtained.

Research Center K - Scientific Research Center for Thermal Machines and Equipment and Environmental Engineering in Energy (METIME)

Brief description: The METIME research center is a research structure created within the Department of Thermal Systems and Road Vehicles within the Faculty of Engineering. It was accredited by CNCSIS in 2003 (Certificate no. 176/CC-C).

Research, development and innovation activities of the center are oriented towards Energy, Environment and climate change. The METIME Center aims to carry out scientific research and technological development in areas of excellence of the University. In the development strategy, the METIME center aims in the main areas such as applied thermodynamics, modeling and numerical simulation of thermogasdynamic processes, refrigeration, cryogenics, air conditioning, internal combustion engines, road vehicles, thermal energy systems, water and air pollution control, renewable energies. Conducted research activities aim at the research, design and development of efficient, economical and environmentally friendly energy systems.

Basic services:

- Refrigeration, cryogenics and air conditioning:
- New performance criteria of absorption systems and the development of a methodology for comparative analysis of refrigeration plants, pumps and heat transformers.
- Development of study programs and process optimization in absorption systems.
- Inventory and valorization of residual energy resources and geothermal and solar energies with the help of absorption systems.
- Reduction of energy consumption through recovery, regeneration, double or multiple effect, coupling of refrigeration installations and heat pumps, accumulation of cold and heat, etc.
- Optimization of processes and equipment in refrigeration and cryogenic facilities with ecological agents and environmental impact studies.
- Thermo-economy of refrigeration, cryogenic and air conditioning installations.
- Development of programs for the design and optimization of devices and machines in refrigeration and cryogenic systems.
- Studies on non-stationary regimes encountered during cooling of bodies, refrigeration and freezing of food products.
- Design and development of installation technologies, samples and testing of refrigerating, cryogenic and air conditioning installations.
- Experimental investigation of dynamic regimes of refrigeration and cryogenic systems.

Thermoenergetics, environmental engineering and numerical modeling:

- Numerical modeling of mass and heat transfer processes.
- Use of renewable energy sources for heating and electricity production.
- Numerical modeling of biomass thermochemical decomposition.
- Numerical modeling of fuel combustion.
- Determination of thermochemical properties of fuels.
- Energy recovery of municipal solid waste (incineration, pyrolysis, gasification and anaerobic digestion.
- Energy, economic and environmental analysis of energy systems.
- Reduction of polluting emissions of thermal energy systems.

Internal combustion engines, propulsion systems and road vehicles:

- Process optimization, design, repair, assembly, testing and maintenance of internal combustion engines.
- Diagnostics of the technical condition and automatic adjustment of piston internal combustion engines.
- Dynamic diagnosis of road vehicles.
- Thermo-economy of energy installations with internal combustion engines.
- Combating pollution from products of internal combustion engines and road vehicles.
- Naval propulsion installations: theoretical and experimental research, combating noise and vibrations, etc.

Research Center L - Mechanics of Machines and Technological Equipment Research Center - MECMET

Short description: The Mechanics of Machines and Technological Equipment Research Center - MECMET was established as a center for scientific research, without legal personality, organized within the Faculty of Engineering and Agronomy from Brăila of the University, Department of Science. Engineers and Management. MECMET was then accredited by the National Council of Scientific Research in Higher Education, in 2004. The research center's main object of activity is interdisciplinary research in the assumed fields of interest. The correspondence of the R&D activity of the center with the fields of intelligent specialization for the strategic cycle 2014-2020 is supported by the partial / total correlation of the strategy and research themes with specific directions in the fields of Energy, environment and climate change, respectively Eco-nanotechnologies and advanced materials.

Core services: Departments and laboratories are organized in the infrastructure of the center, as follows:

- Mechanics.
- Actuation Systems.
- Equipment, Technologies, Mechanization and Recreation in Construction.
- Computer Simulation and Virtual Instrumentation.
- CAD, CAM, Virtual Prototyping laboratory
- Assisted Engineering and Virtual Prototyping Laboratory.
- Complex Measurement Technique and Virtual Instrumentation Laboratory.
- Laboratory of Hydraulic and Pneumatic Actuations.
- The Laboratory for Structural Behavior Analysis.
- Fluid Mechanics Laboratory.
- Materials Science and Engineering Laboratory.
- Electric Machines and Actuators Laboratory.
- Laboratory of Technical Mechanics and Deformable Media.

Research Center M Naval Architecture Research Center (CCAN)

Brief description: The Naval Architecture Research Center (CCAN) operates at the Faculty of Naval Architecture, Department of Naval Architecture. It was accredited at the national level through the CNCSIS certificate no. 30/CC-C/2001, from 2001. The research, development and innovation (CDI) activity within the CCAN center falls under the priority area of smart specialization for the 2014-2020 cycle, Energy, environment and climate change. CCAN is organized in two departments, which also profile the fields of skills and expertise in which the centre's main R&D activities are carried out, as follows:

- "Naval Hydro-Aerodynamics" Department.
- "Naval Structures" Department.

The research center, conceived as a pole of excellence in the field, undertakes the mission of contributing to the enrichment of the knowledge heritage in the naval field, through scientific research. It aims to provide the members of the university community involved with the necessary conditions for capitalizing on skills, through scientific research. It declares its role as a catalyst for research activities in the field of naval deployment in the country, by continuing its traditional links with the institute and national research organizations in the field, as well as with traditional shipyards. It aims to create an efficient framework for attracting extra-budgetary financial resources, necessary for good functioning.

The fulfillment of the mission of the CCAN center is ensured by the following levers:

- a flexible organizational structure, sensitive to social order.
- planning and streamlining modern and balanced development based on the requirement of existing research products in the real way now in the country.
- applying the principles of total quality management in the organization and management of activities.
- co-opting the framework of the various research collectives of the most valuable scientific ones in the country and abroad.
- promoting and supporting interdisciplinarity by encouraging collaboration between university departments. The center is conceived as a consortium formed by the department, to which any other member of the academic community can join, notable achievements in the fields of contracted research themes.
- the organization of conferences, colloquiums, work meetings, which favor contacts between students, academics and industry specialists.
- intermediation of joint University-Industry research, this can be realized through a research contract, for the promotion of new technologies.
- dissemination of the output of the activities in the Romanian naval community.
- publishing articles in prestigious domestic and foreign magazines, participating in domestic and international conferences and symposia.
- book publishing (monographs, university textbooks, etc.) on a national and local level.

- performing other services and activities compatible with the purpose of the CCAN center, which do not harm the interests of other natural and legal persons and do not contravene legal norms.

Core services: The CCAN Center offers a diverse range of consultancy, expertise and technological transfer services (http://ugal.ro/files/cercetare/2017/0_Catalog_CCPU.pdf) for the socio-economic environment, aimed at:

- generation and optimization of ship hull shapes.
- numerical modeling of the flow around naval hulls.
- the preliminary estimation of the performance of resistance to advance, propulsion, maneuverability and behavior on waves of the ships.
- structural optimization of ship hulls and marine structures.
- analysis of the static and dynamic behavior of naval structures.
- tests on scaled experimental models to determine the hydro-aerodynamic performance of ships.
- tests on experimental scale models to determine the performance of naval propulsion.
-

Research Center N Research and Development Center of Excellence in Numerical Modeling and Simulation CE-CDMSN

Brief description:

The Research and Development Excellence Center in Numerical Modeling and Simulation CE-CDMSN within the Faculty of Mechanics, was established by the Decision of the Senate of the University "Dunărea de Jos" of Galati no. 26025/29.09.2011. The Center of Excellence was established as part of the "Software Endowment Offset Project" run by Lockheed Martin Overseas Corporation and Siemens Industry Software through the Romanian OFFSET Authority. The increase in the weight of research activities in the field of polymer processing required the change of name to the Center of Excellence for Polymer Processing CE-PP, established by the Decision of the Senate of the University "Dunărea de Jos" of Galati no. 155/22.10.2015.

The main scientific research and technological/experimental development activities carried out within the CE-PP center fall within the fundamental field of Engineering sciences, the branch of science Mechanical engineering, mechatronics, industrial engineering and management.The vision of the CE-PP center is consistent with the need of the local economic environment, of the local labor market, respectively with Romania's strategic policy of economic growth in the short and medium term, with the efforts of gradual alignment with the requirements and political objectives of the European Union, imposed of the need to increase the capacity and competitiveness of the education and research-development-innovation systems, as well as their adaptation to similar systems in the other member states of the European Union. The main goals of CE-PP are stability in accordance with its main field of activity: *polymer processing.* The strategic objective of the CE-PP center is to become one of the reference centers in South-East Romania in the research and development of advanced polymer materials. The main purpose of the CE-PP Center is to carry out scientific research,

innovation and technological development activities in the field of polymer processing, for the development of high-tech products, promoting sustainable development and ensuring active collaboration between the academic and economic environment. Also, CE-PP aims to train human resources and provide technical assistance for the development of new products, improvement of technical-economic performance, applied research, design and capitalization of innovative technical solutions.

Core services: The CE-PP Center offers a diversified range of consultancy services, expertise and technological transfer for the socio-economic environment, in the fields of:

- Injection molding manufacturing.
- Filament manufacturing for 3D printing.
- Prototyping by 3D printing (thermoplastic extrusion) (conceptual models, functional prototypes, spare parts).
- Determination of flow index for polymeric/composite materials.
- Artificial thermal aging tests (-40°C- 170°C).
- Determination of pVT diagrams and viscosity curves by capillary rheology.
- Determination of mechanical characteristics for polymer/composite materials (tensile, 3- and 4-point bending, foils, films).
- Determination of mechanical characteristics for polymeric materials at the micro and nano scale.
- Measurement of electrical properties.
- Computer-aided design NX, NASTRAN, Moldflow (injection molds, etc.).
- Cutting polymer/composite materials.

Research Center O - Research Center Automatic Process Control Systems (SCAP)

Short description: The Research Center Automatic Process Control Systems (SCAP) is organized within the Department of Automatic and Electrical Engineering, within the Faculty of Automatic, Computer, Electrical and Electronic Engineering. The center also has modern and high-performance logistics, with equipment of a high scientific level. The correspondence of the CDI activity with the fields of intelligent specialization for the strategic cycle 2014-2020, converges to the fields: Information and communication technology. Space and Security, AND Energy, environment and climate change.

The main strategic objective of the SCAP Center is the development, area, integration and correlation of the promotion of scientific research and technological development activities in the national and European research space, in the field of Systems Engineering, through the stability of research relationships with relevant universities and related research laboratories. from Romania and the European Union. The main objectives of the CDI activity carried out in the center aim at:

- Proposing and carrying out research through scientific research programs, in current directions on a global scale.
- Development of the research material base within the center, to align with European standards.

- Supporting and providing scientific support to bachelor's, master's and doctorate study programs.
- Supporting the organization of local, national and international scientific events.
- Supporting the editing and publication of the Annales University "Dunarea de Jos" from Galati, Volume III Electrotechnics, Electronics, Automatic Control and Informatics, edited by the ACIEE Faculty.
- Scientific collaboration with Romanian and foreign partners to carry out joint research.
- Attracting researchers from abroad, through internship programs offered through international agreements and programs.
- Expanding collaborations with the socio-economic environment.

Core services: The SCAP Center offers consultancy, expertise and technological transfer services for the socio-economic environment, as follows:

- Studies on the use of the *Particle Swarm Optimization method* in the optimal management of some nonlinear dynamic systems.
- Studies on the use of hybrid metaheuristics in the optimal control of dynamic nonlinear systems.
- Studies on the use of multiagent systems in the optimal management of wastewater collection networks.
- Solving parametric (stationary) and dynamic optimization problems using conventional or artificial intelligence techniques. Model, study and computer model to solve the problem are provided.
- wastewater treatment plants.
- Studies on modeling and automatic control of anaerobic digesters.
- Studies on modeling and automated control of photobioreactors.
- Studies on modeling and automatic control of manipulators and industrial robots.

SISCONTROL Laboratory:

- Structural design of intelligent driving based on advanced (backstepping, sliding-mode) Intelligent Autonomous Systems - Personal Robotic Assistant (SAC-ARP) and Intelligent Autonomous Systems - Multidirectional Autonomous Vehicle (SAC-VAM) integrated in medico-social assistance technologies of flexible precision manufacturing lines, Assembly/Disassembly (A/D) and Processing/Reprocessing (P/R), laboratory (mechatronics lines) and industrial.
- Ultrasonic and laser-based navigational structural design of SAC-ARP and SAC-VAM integrated in medico-social assistance technologies and servicing of precision, laboratory (mechatronics lines) and industrial flexible manufacturing lines.
- Design of mobile visual servoing systems placed on manipulators equipping SAC-ARP and SC-VAM.
- Hybrid Driving Techniques for Precision Flexible Manufacturing and Assembly Systems with SAC-VAM and SAC-ARP Integration

- Technologies for assisting elderly people with severe neuromotor disabilities using the integrated autonomous system Complex Autonomous System - Intelligent Chair.

Research Center P - Center for advanced welding research (SUDAV)

Brief description: The Center for Advanced Welding Research (SUDAV) was established in 2006 (Certificate CNCSIS 7/12.09.20016) and operates within the Faculty of Engineering, Department of Manufacturing Engineering.

The SUDAV Center, through the expertise and visibility of its members, is integrated into networks of institutions and specialized bodies recognized and active at the national and international level, which ensure the police of excellence, scientific and technical competence of reference, in the fields of advanced sciences and technologies.

The objectives and R&D activities of the SUDAV research center are consistent with the field of intelligent specialization for the strategic cycle 2014-2020: Eco-Nanotechnologies and Advanced Materials. The strategy of the SUDAV Research Center aims to promote high-performing fundamental and applied research, by stimulating collaboration, the exchange of ideas and experience, with similar units from the country and abroad, with economic and industrial units, based on bilateral agreements or within national programs. and/or international.

The Mission of the SUDAV Research Center, conceived as a pole of excellence in the development of fusion and pressure welding technologies, is to carry out fundamental and applied scientific research, as well as the execution of activities related to research-development-innovation, providing consultancy. and the dissemination of research results through publications or scientific events, as well as the realization of technological development activities in the field of industrial engineering and management.

Basic services: The SUDAV Center offers a diverse range of consultancy services, expertise and technological transfer for the socio-economic environment (http://ugal.ro/files/cercetare/2017/0_Catalog_SUDAV.pdf).

Research Center Q - Center for Research in Electronics, Information Technology and Communications (CCETIC)

Brief description: The Center for Research in Electronics, Information Technology and Communications (CCETIC) was established in 2009, within the Faculty of Electrical and Electronics Engineering, within the Department of Electronics and Telecommunications.

Area of research fields fields:

- Signal processing.
- Information processing and transmission.
- Intelligent and autonomous electronic systems.
- Soft computing techniques.

CDI activities carried out by the CCETIC center converge the moment of intelligent specialization for the strategic cycle 2014-2020 "Information and communication technology, space and security".

Basic services: The center offers consulting services, expertise and TT for the socio-economic environment http://ugal.ro/files/cercetare/2017/0_Catalog_CCETIC.pdf), as measurements of physical, electrical and non-electrical quantitiesm, digital data acquisition and processing, data analysis for identification, filtering and classification purposes, image processing for filtering, detection and classification purposes.

Research Center R - "Lunca" Agronomic and Environmental Research and Consultancy Center (CCCAM Lunca)

Brief description: The "Lunca" Agronomic and Environmental Research and Consultancy Center (CCCAM Lunca) ensures:

- Promoting collaborative relationships, partnership on projects related to postgraduate training and reconversion with universities, centers, institutions, similar research units in the country and abroad.
- Encouraging knowledge transfer and innovation in agriculture and rural areas, focusing on the following aspects:
    a. encouraging innovation, cooperation and the creation of a knowledge base in rural areas.
    b. strengthening the links between agriculture, food production and forestry, on the one hand, and research and innovation, on the other, including for better environmental management and established environmental performance.

Core services:

- Assessment and monitoring of agricultural crops.
- Biological and ecological study of some agricultural plant species.
- The creation of high-performing varieties and hybrids, adaptations to the conditions of Northern Bărăgan.
- Ensuring the sustainable management of natural resources and combating climate change.
- Quality assurance through the elaboration, development and promotion of specialized activities of auditing, technical approval, technical inspection and laboratory tests in the field of environmental protection.
- Achieving a balanced territorial development of rural economies and communities, including the creation and maintenance of jobs.
- Involvement of the center in the analysis of the development of the specific socio-economic environment and the provision of consulting services.
- Increasing the viability of holdings and the competitiveness of all types of agriculture in all the arial areas presented above and the promotion of innovative agricultural technologies and the sustainable management of rural space, with an emphasis on the following aspects:
    a. achieving the economic performance of all agricultural holdings and facilitating the restructuring of the modernization of holdings, especially with a view to increasing market participation and market orientation and diversifying agricultural activities.
    b. facilitating the entry of qualified farmers into the agricultural sector, and particularly the renewal of generations.

- Restoring, preserving and strengthening ecosystems that are linked to agriculture with emphasis on the following aspects:
  c. restoring, preserving and developing biodiversity, including in Natura 2000 areas and in areas facing natural or other specific constraints, of agricultural activities of high natural value, as well as the state of European landscapes.
  d. improving water management, including fertilizer and pesticide management.
  e. preventing soil erosion and improving soil management.

Research Center S - Research and development center for thermosetting matrix composites (CCDCOMT)

Brief description: The research and development center for composites with thermoset matrices (CCDCOMT) was established in 2016, within the Transfrontier Faculty, Department of General Sciences.

Research, development and innovation (RDI) activities are carried out in the fundamental field: Mechanical Engineering/Materials Science/ Composite Materials and Structures.

1. **Main areas of research-development-innovation**

- Fabric reinforced composite materials for automotive applications:
  - design and formation of reinforced composite materials with special properties of different types of stress.
  - design, forming and testing of fabric-reinforced composite materials made from man-made and natural fibers or bundles.
- Designing the properties of polymer matrix composite materials:
  - designing the properties (mechanical, tribological, physical) of composite materials with thermosetting matrices.
  - the study of the properties of thermosetting polymer mixtures to use them for the design of better performing composites.
  - the use of modified polymers to cover surfaces exposed to subsequent cavitation erosion.
  - designing the properties of composite materials with thermosetting matrices by designing the fabrics used for their reinforcement.
  - using stationary magnetic fields to nano-structure polymers by aligning nanometric compounds with magnetic properties in the polymer matrix.
- Composite materials with modified polymer matrices:
  - modification of polymer properties (to improve the quality of composites) through various techniques.
  - the use of amino acids for the functionalization of polymers.
  - the use of metal complexes of amino acids for the functioning of polymers.
  - nanostructuring of polymers by the development of chemical reactions in the volume (liquid) of their prepolymers.
  - nanostructuring of polymers by thermal degradation (microwaves) of organic precursors dispersed in volume (liquid) of prepolymers.
  - nanostructuring of polymers by electromagnetic (laser) degradation of some precursors dispersed in the polymer.

- Formation and characterization of composite materials.

2. Secondary fields of research-development-innovation

- Materials testing and characterization.
- Multifunctional composite materials - obtaining multifunctional composites by applying innovative technical solutions.
- Tribology and tribocorrosion.

3. Services / micro production

- Formation of composite materials.
- Formation of composite structures.

1. Multidisciplinary and interdisciplinary research topics

- The study of the properties of thermosetting polymer mixtures to use them to obtain nanostructures using electro-chemical methods, which will be used to modify the properties of the polymers.
- Obtaining metal nano-powders through microbiological and biochemical processes, either as such or directly in polymer matrices.
- The use of microbiology and biochemistry techniques to create the properties of natural fibers.
- Optimization of nanocompound dispersion methods in polymer matrices.
- Optimizing the design of composite materials by using numerical analysis models and computer simulation.
- Optimizing the design of physical properties of composite materials using neural network techniques.

Core services: From the point of view of competitiveness on the market of materials testing and characterization services, the activity of the CCDCOMT center is focused on the accreditation of the largest possible number of analyses, so that by grasping the activities offered the research unit becomes a credible partner on the market local. The assumed mission of the CCDCOMT center is the identification of innovative technical solutions that allow obtaining better performing composite materials, applicable in the automotive industry, the naval industry, the energy industry and which ensure - under the conditions of compliance with all regulations related to environmental protection - a level increased. of security in exploitation alongside a high economic efficiency.

The vision of the CCDCOMT center considers:

- Establishing a program of indirect support actions for research, such as the training of researchers and engineers in the issue of industrial rights and intellectual property.
- Development of marketability in the field of innovation.
- Facilitating access to innovation support and commercialization services. Encouraging the acquisition and exploitation of intellectual property.

T Research Center - Interdisciplinary Center for Artistic Studies (CISA)

Brief description: The Interdisciplinary Center for Artistic Studies (CISA) was established in 2015, within the "Dunărea de Jos" University of Galați, Faculty of Arts and started with 23 members, currently reaching 31 members. The fundamental field is "Humanities and Arts" and the research directions are Music, Visual Arts and Theater and Performing Arts. The center's activity consists of individual artistic

projects that ensure representativeness in all research directions, but also in interdisciplinary and collaborative projects with a research and innovation component, which bring together art, science and technology. The main research directions are Music, Visual Arts and Theater and the performing arts, and the approach aims at creative aspects (creations, operas, plays, performances, audio-visual/multimedia products, plastic creations, etc.), organizational aspects (cultural and artistic management, organization of events, implementation of funded projects, collaborations and partnerships, artistic consultancy and artistic and/or cultural management, etc.) and theoretical aspects (volume, articles, publications, etc.). CISA members are encouraged to propose and carry out regionally, nationally and internationally relevant artistic and artistic research projects that are capitalizable and relevant from an artistic and economic point of view.

Basic services:

- Consultancy, assistance or production services regarding creations, works, plays, performances, audio-visual/multimedia products, dramatic texts, plastic creations.
- Services for organizing workshops and workshops with an artistic theme or artistic management, with a wide range of applications: information, creation, teambuilding, etc.
- Production or consulting services in the production of shows, concerts, recitals, plays, various artistic manifestations, etc.
- Consultancy and expertise in the development and implementation of funded research or cultural projects.
- Consultancy in the organization and implementation of collaborative artistic projects.
- Consultancy in the development and implementation of cultural strategies and policies.
- Consultancy in the creation of documentation specific to the cultural-artistic sector: guides, methodologies, programs, etc.

Research Center U - Multidisciplinary Integrated Center for Dermatological Interface Research (CIMCID)

Brief description: The main mission of the Integrated Multidisciplinary Center for Dermatological Interface Research (CIMCID) is to promote multidisciplinary, fundamental and high-performing applied research in the fundamental field of Biomedical Sciences, the exchange of ideas and the experience gained in this field to the academic community of the University and researchers external with direct implications on the development of research studies, residents, doctoral and postdoctoral research. The Integrated Multidisciplinary Center for Dermatological Interface Research from University, hereinafter referred to as CIMCID, is an academic research unit without legal personality, organized within the University, with the integration of the Clinic in The Clinical Hospital for Infectious Diseases "Saint Pious Parascheva" in Galati. Having a multidisciplinary character, CIMCID has as associated members' specialists within the University, as well as from

outside UDJG, from the country and abroad. In the case of valid realizations of the experiments and measurements, especially those related to the topical preparation with therapeutic value, studies will be carried out and sent for publication to national/international specialized journals.

Basic services:

- Development of entrepreneurial perspectives and skills by researchers, teaching staff, doctoral students, master's students, postdoctoral researchers, students and employees within UDJG.
- Detection by capillaroscopy, trichoscopy, confocal microscopy with in vivo laser scanning, coherent optical tomography, skin ultrasound, -in the future- of pathological changes and therapeutic effects on normal skin and in various skin pathologies.
- Promoting a supported activity of multidisciplinary, fundamental and applied research aligned with European and international requirements and exigencies, in collaboration with the similar research group in the country and abroad.
- Promoting the interdisciplinary/multidisciplinary role.
- Involvement of students, residents and PhD students alongside teaching staff and researchers with concerns in the field.
- Engaging students and faculty in outreach/promotional activities with opportunities to specialize in leading scientific and technological fields. –
- Creating and developing a multidisciplinary database and connecting CIMCID to national and international networks of the profile.
- Posi organizes scientific events (symposiums, conferences, congresses) and edits newsletters, articles, magazines, courses, book chapters related to the CIMCID field;
- Supporting CIMCID members' participation in scientific events, seminars, colloquiums, fairs and exhibitions related to CIMCID's objectives; - The inclusion of CIMCID activity in the national, European and international circuit of scientific values through collaboration with other research centers in the country and abroad and through the affiliation of the center to national, European and international research networks.
- The national CIMCID proposes that, depending on the opportunities, support the implementation of innovative technologies, observations, clinical, imaging, paraclinical, therapeutic results, etc., developed within the research center, through technological and international transfer to the interested units and entities.

With the help of the existing technology within the Laboratory of Dermatological Imaging Investigations, the following objective is transacted

- Follow-up, monitoring, direct and differential diagnosis for various dermatological pathologies, from inflammatory, tumoral diseases.
- Carrying out digital videomatoscopy, with the possibility of dynamic tracking of pigmentary lesions and various dermatological pathologies.
- Clinical, dermoscopic and confocal microscopy and optical coherence tomography characterization of (pre)cancerous skin lesions, as well as melanocytic nevi.

- Monitoring and early identification of skin lesions with a risk factor (mainly nevi with malignant potential)
- Making a "map" of the nevi - (the dermoscopic map consists of recording the dermoscopic images of the nevi in electronic format, which can be consulted at regular intervals for periodic monitoring.
- Monitoring the dynamics of the effects of different topical and dermatocosmetic treatments, of changes in skin vascularity.
- "In vivo" identification of skin structures, clinical, dermatoscopic, histopathological correlation
- Objective skin level of changes induced by external factors and various known subjects or experimental products in the project, from various extracts, with the use of waters.
- The study of the actions of some natural extracts with topical antimicrobial and anti-infection roles in the context of antibiotic resistance.

Research Center V - Research Center for Human Performance (CCPPU)

Short description: The Performance Research Center (CCPPU), within the Faculty of Physical Education and Sport, is a pole of excellence in the field and undertakes the mission of contributing to the enrichment of the knowledge heritage in the field of physical education and sport through scientific research. The CCPPU Center was established according to the decision of the Senate of the "Dunărea de Jos" University of Galați, no. 168/18.03.2004.

4.1.3 Public and private initiatives supporting the TT ecosystem

Initiative A (Depending on the initiative, some of the following points may or may not apply. PPs may customize as they see fit.)

- **Mission and Objectives:** In Romania, the Ministry of Research and Innovation (MCI), now known as the Ministry of Research, Innovation and Digitization, has a crucial role in the development of public policies that support technological transfer and the promotion of specialist investors. Its role in this context is essential for stimulating innovation, economic competitiveness and sustainable economic growth of Romania.
- **Operations:**
  - **Services offered**: MCI is responsible for developing and implementing public policies for research and innovation, promoting technological transfer, coordinating specialized providers, supporting innovation and technological start-ups, promoting international collaboration. The Ministry of Research, Innovation and Digitization plays an essential role in the development and implementation of policies that support technological transfer and innovation in Romania. By collaborating with specialized services and by administering national and European funds, the ministry facilitates the collaboration of the academic and private environments, supporting the development of an economy based on knowledge and advanced technologies.
  - **Funding mechanisms:** Sources of funding for TT activities (eg government grants, industry partnerships, internal university funds).

- **TT policies/strategies:** (ie including IP management and commercialization strategies, spin-off creation, etc.)

The Ministry supports the Technology Transfer in several ways:

- **Technology Transfer Centers** (CTT): CTT are organizational structures designed to facilitate the interaction between academia and the business environment. The Ministry, the specialized department and its programs, support the creation and development of these centers, which contribute to the application of scientific knowledge in practice. Currently, at the national level, 38 authorized Technology Transfer Centers (TTCs) and 10 provisionally authorized entities are operational (Ministry of Research, Innovation and Digitalization, 2024).
- **Funding programs and grants:** The Ministry administers national and European Funds for Research and Innovation. For example, programs such as PNCDI III (National Plan for Research, Development and Innovation) provide financial support for projects that encourage collaboration between the public and private sectors, thus promoting innovation and technology transfer.
- **Research infrastructure RIs:** Research Infrastructures RIs, as defined in this Report and based on the CRIC's Strategic Report (December 2016) and EU Regulation no. 651/2014, refer to facilities, resources, and services used by the scientific community for research. These include scientific instruments, knowledge resources (such as archives and databases), ICT-based infrastructures (networks and software), and any other tools essential for conducting research. RIs can either be located at a single site or distributed across multiple locations as part of an organized resource network.
-

Through the national legislation currently in force, the entities that carry out research and development activities are included in a national system. The national research and development system is made up of all the units and institutions of public law and private law with legal personality, which have research and development as their object of activity.

The RDI System in Romania includes 263 public RDI organizations and around 600 enterprises. Among the public organizations, 56 are authorized public universities, 46 are national research and development institutes (43 of which are coordinated by the Ministry of Education), and 65 are research institutions and centers of the Romanian Academy. The National Network for Innovation and Technology Transfer (ReNITT) comprises 50 specific organizations: technology transfer centers, technology information centers, technology and business incubators, and 4 science and technology parks.The Research-Development System of National Interest includes categories of public law units, according to Law no. 324/2003: National RD Institutes; Research Institutes, Centers/Stations of the Romanian Academy and Research and Development of the Branch Academies; accredited higher education institutes or their structures; RD Institutes/Centers organized within national societies, National Companies and Autonomous Regions of National Interest. The national research-development system also includes the following categories of units and institutions: public law units and institutions (RD Institutes, Centers or stations; research-development institutes or centers

organized within national societies, national companies and autonomous regions or central and local public administration; international research and development centers established on the basis of international agreements; other public institutions or their structures, whose object of activity is research and development) and private law units and institutions(RD units organized as commercial companies; commercial companies, as well as their structures, whose activity is research-development; accredited private higher education institutions or their structures). Organized according to their level of maturity, Ris could be: Emerging (in the phase of synchronization with the stated objectives – feasibility studies, implementation/construction plans and cost-benefit analysis) with a relatively low degree of maturity, being in the process of structure and governance establishing and having high potential to reach active/landmark status until the next roadmap revaluation; Active (in the design and/or construction stage, based on the realized feasibility study, with a high degree of maturity and a well-defined structure and governance); Landmark (already operational and need to support technologica upgrades and/or to be maintained in an appropriate state of operation). The Ministry invests in the development of research and innovation infrastructure, including science and technology parks, center of excellence and collaborative research platform. These facilities are essential for the development of new technologies and their application in industry.

- **Internal processes and practices:** (e.g. innovative approaches, technology licensing processes, technology marketing strategies, terms and forms of service delivery, industrial collaborations and partnerships and evaluation and monitoring of technology transfer projects, internationalization of TT activities, etc.).

The Ministry collaborates with several specialized services and organizations that play an important role in promoting research and innovation in Romania, as follows:

- **UEFISCDI (Executive Unit for the Financing of Higher Education, Research, Development and Innovation):** This is the main agency that administers funds for research and innovation projects, including those that facilitate technology transfer. UEFISCDI provides support for collaborative projects between academia and private industry.
- **ANCS (National Authority for Scientific Research and Innovation):** This is the responsibility for coordinating and implementing national strategies in the field of research and innovation. ANCS promotes projects aimed at integrating innovative technologies into the real economy.
- **ADR (Regional Development Agencies**): They play an active role in facilitating collaboration between SMEs and research institutions, supporting technology transfer at local and regional level.

The Ministry encourages the development of innovation ecosystems, which includes Technological Start-Ups, Innovative SMEs and other business entities that contribute to the development of new solutions and technologies. Through national and European funds, the ministry supports:

- Innovative Start-Ups and SMEs developing new products or services based on research results.

- Business Incubators and accelerators that help these start-ups to develop and implement the developed technologies.
- Public-Private Partnerships to create consortia to implement applied research and innovation projects.

Major achievements: Key successes in promoting technology transfer and innovation. The Ministry encourages and facilitates international collaborations in the field of research and innovation, participating in European and international programs such as:

- Horizon Europe: The European Union's framework program for research and innovation, which provides funding for projects aimed at technology transfer and innovation.
- Bilateral and Multilateral Partnerships: The Ministry fosters development with other states and international organizations to facilitate the exchange of knowledge and technologies.

Financing mechanisms: government budget allocation, international cooperation funds and private sector contributions.

The Institutional Development Fund (FDI) is relatively recent component (mechanism) of Romanian institutional funding in the form of a project-based competition with the purpose of supporting public higher education institutions (HEIs) in implementing their institutional strategic plans in their pursuit of the national strategic objectives. This policy aims to encourage universities to formulate their own answers (through institutional projects) to current challenges such as internationalisation, regional development, supporting the entrepreneurship (Nica and Jitaru, 2022).

Complementary public funding: in addition to the basic funding provided to universities, complementary (also called supplementary) funding is granted by the Ministry of Education through funds allocated on competitive basis for academic scientific research among others. This is distributed according to the results obtained by universities on a series of performance indicators and the main role of the supplementary funding is linked to boosting performance in several major areas one of which is research. Supplementary and basic funding are both distributed as per student, and it is thus not only a function of the university performance but also of its size in terms of the number of students (Ministry of Education, n.d.).

Budgetary Fund for Scientific Research at Universities: a fund under the Ministry of Education dedicated to the funding of scientific research in state HEIs and for year 2023 the envisaged amount was RON 100 million (about EUR 20 million). Eligible expenditures include staff costs, materials and capital expenditure (Ministry of Education, 2023).

Values and impact: statistical data on the number of patents filed, licenses issued, startups launched, and the overall economic impact generated.

4.2 Key findings on TT processes and practices

Romania's technology transfer (TT) landscape has evolved significantly, shaped by historical, political, and economic developments. The country's experience in TT

reflects both notable achievements and ongoing challenges that continue to impact the efficiency and effectiveness of technology commercialization efforts.

Institutionalization of TT Structures

The establishment of Technology Transfer Offices (TTOs) in Romanian universities, such as at the "Dunărea de Jos" University of Galați (UDJG), represents a key milestone in facilitating innovation and technology dissemination. The creation of the Department of Continuous Training and Technology Transfer (DFCTT) within UDJG, along with the CTT-UGAL, marked an important step in formalizing the process of transferring knowledge from academia to industry. These entities play a crucial role in connecting academic research with the needs of the business environment, particularly in regional industries like the food and naval sectors.

Evolution of TT Policies and Practices

The Romanian government's focus on aligning with European Union (EU) standards, especially post-EU accession, has spurred the growth of TT mechanisms. The National Strategy for Research, Innovation, and Intelligent Specialization (2022-2027) aims to foster closer collaborations between universities, research institutes, and industry. Despite this, challenges persist in terms of low R&D investment, which remains far below the EU average. Bureaucratic inefficiencies and a fragmented legislative framework also inhibit the seamless transfer of technologies.

Funding and Support Mechanisms

Romania's access to European funding programs, such as Horizon 2020 and the Regional Operational Program (POR), has provided substantial support for TT initiatives. However, low absorption rates of these funds continue to be a major issue due to administrative hurdles and uneven regional capacities. For instance, while certain regions like Bucharest-Ilfov attract significant venture capital, others struggle to secure such investments, limiting the national TT ecosystem's overall effectiveness.

Case Studies of Successful TT Initiatives

Several successful technologies transfer initiatives, such as the development of vegetable-based spreadable products at UDJG, illustrate the potential of Romanian universities to lead innovative research with direct commercial applications. Products like the spreadable paste made from whole bean and lentil flour, transferred to Sanovita, exemplify the collaboration between academic researchers and industry. The product's success at international competitions like Ecotrophelia underscores the value of university-led TT activities.

Challenges and Opportunities in TT Processes

Key challenges for technology transfer in Romania include:

- Underdeveloped Infrastructure: Many universities and research institutes lack the infrastructure to support large-scale technology commercialization.

- Human Resource Gaps: The brain drain phenomenon continues to drain talented researchers and PhD graduates, limiting Romania's ability to scale innovation.
- Regulatory and Bureaucratic Barriers: Complicated bureaucratic procedures for patenting and technology licensing discourage businesses from collaborating with academic institutions.
- Regional Disparities: There is a significant disparity in the distribution of TT activities across Romania, with some regions, like Bucharest-Ilfov, benefiting disproportionately from venture capital and innovation funds.

Despite these challenges, opportunities exist in sectors such as IT&C, renewable energy, and biotechnology, which have seen increased interest from foreign investors and multinational corporations. The Romanian government's efforts to promote green technologies and Industry 4.0 initiatives also create new avenues for TT.4.1. We aim to include a discussion of the main commonalities and differences. Romania's TT ecosystem, while still developing, shows promise through its integration into the European innovation space and its ability to leverage university-industry collaborations. However, realizing the full potential of TT processes requires addressing systemic challenges related to infrastructure, funding, and human resource development, as well as fostering greater public-private partnerships.

4.3 SWOT analysis

STRENGH	OPPORTUNITIES
1. **Tradition and existing scientific infrastructure:** Romania has a network of well-developed universities and research institutes that can provide valuable results for industry. *2.* **There are centers of excellence:** Institutions such as "Dunărea de Jos" University in Galaţi, Politehnica in Bucharest and other centers of excellence in technical fields can be a starting point for technological transfer. *3.* **Access to European funds:** Programs like Horizon Europe and European Structural Funds provide essential financial and strategic support, enhancing the capabilities of Technology Transfer Offices (TTOs).	*1.* **European funding for innovation and research**: The programs offer considerable opportunities for funding technology transfer projects. Romania has access to substantial EU funding aimed at enhancing innovation and research commercialization. *2.* **Increasing interest in digitization and green transition**: The transition to a digital and sustainable economy opens new opportunities for collaborations in areas such as green energy, advanced technologies and artificial intelligence, providing an ideal framework for technology transfer. Industries like biotechnology and green energy are growing, demanding innovative solutions. *3.* **Possibilities for international collaboration**: Partnerships with research institutions and companies in other countries, as well as participation in

4. **Growing interest in innovation**: Romania has a strong academic base, with several research institutions producing high-quality research in fields like engineering, information technology, and biotechnology, providing a solid foundation for technology transfer. *5.* **Emerging Innovation Hubs**: Certain Romanian institutions excel in tech transfer, creating spin-offs, startups, and filing patents.	international technology transfer networks, can bring additional expertise and resources. *4.* **Increasing investments in innovation and start-ups**: The development of start-up ecosystems and investments by venture capital funds in innovative companies can support technology transfer and the application of research results. 5. **Potential for University-Industry Collaboration**: There is significant untapped potential for collaboration between universities and industry.

WEAK	THREATS
1. **Lack of a clear normative and strategic framework:** Technology transfer policies are not well defined and coherent, and government support for innovation and knowledge transfer is insufficient and fragmented. *2.* **Insufficient funding:** The technology transfer system in Romania is poorly funded, which limits the ability to develop applied research projects and collaborations between universities and industry. *3.* **Limited technology transfer infrastructure:** There are few specialized centers to directly support technology transfer, business incubators and science parks, and the existing ones do not have effective national coverage. *4*. **Low number of patents and commercialized innovations:** Romania has a relatively small number of patents and research results transformed into commercial products or services, which indicates that the knowledge generated in the academic environment is underutilized. *5.* **Lack of expertise in technology transfer**: Firms and researchers have difficulties in the process of commercializing innovations, due to the lack of expertise and support structure to facilitate this process.	*1.* **Migration of talent and researchers**: Brain drain is a major threat with many researchers and technology professionals choosing to work abroad due to better opportunities. The emigration of highly skilled researchers and innovators weakens Romanian institutions' capacity to retain talent and translate research into marketable technologies. *2.* **Lack of political support and legislative fluctuations**: Frequent changes in the legislative framework and inconsistent policies can reduce the confidence of investors and researchers in the ability to carry out long-term technology transfer projects. *3.* **International competition**: Other European countries, with better developed and better financed technology transfer systems, attract investors and companies that could collaborate with Romanian institutions, but choose more favorable options. 4. **Delay in their emerging implementation:** If Romania fails to modernize the rapid research and innovation infrastructure, it risks falling behind emerging technologies in their implementation, such as artificial intelligence, robotics or biotechnologies. 5. **Low Awareness of Intellectual Property (IP**) Rights: Limited awareness among researchers and industry partners restricts the utilization of IP assets.

A SWOT analysis is a valuable tool for assessing the strengths, weaknesses, opportunities, and threats within Romania's technology transfer ecosystem. By systematically evaluating these four dimensions, stakeholders—including universities, research centers, policymakers, and private enterprises—can gain a clear understanding of the current state of technology transfer. This analysis helps

identify both the potential areas for growth, such as increased collaboration between academia and industry, and the barriers that must be addressed, like inconsistent performance among institutions and limited commercialization of research. Moreover, it highlights how Romania can leverage external funding and emerging innovation ecosystems while mitigating threats like economic instability and global competition.

To prioritize the SWOT results, the prioritization matrix can be used to better address the country context and form the first action plan for policy development in technology transfer. The matrix ranks all possible SWOT findings according to two criteria/dimensions, while each criterion can have three different values (low, medium, high).

Prioritization will be done based on the expertise of the authors and, if necessary, the expertise of an expert panel consisting of 2-3 members of each major category of stakeholders in your country that you consider appropriate (ie academics, TTO professionals, industrial and institutional partners).

- 1 st **criterion**: **the chance of appearing** for a SWOT finding/statement
- the 2nd **criterion**: **The possible impact** of the SWOT finding in the country

▪ SWOT findings that fall within **the dark gray areas** are considered high priority for policy making

▪ SWOT findings that fall within **the medium gray areas** are considered of medium priority for policy making.

▪ SWOT findings that fall into **light gray areas** are considered low priority for policy making

Table 2. Prioritization matrix

Priority	Action Area	Impact	Effort	Urgency	Priority Level
1	Develop Institutional Policies	High	Medium	High	High
2	Regulatory Country Frameworks	High	High	High	High
3	Strengthen Collaboration with Industry	High	High	High	High
4	Leverage EU and Government Funding	High	Medium	High	High
5	Improve Human and Financial Resources in TTOs	Medium	High	High	Medium
6	Address Brain Drain by Retaining Talent	High	High	High	High
7	Promote Innovation and Startups Through Incubators/Accelerators	Medium	Medium	Medium	Medium
8	Increase Patent and Intellectual Property Outputs	Medium	High	Medium	Low
9	Spin-off Creation	High	Medium	Medium	High
10	Mitigate Economic Instability's Impact on R&D	Medium	High	Medium	Low

11	Establish Pool of Experts	High	Medium	High	High
12	Promote Open Innovation as Tech Transfer Pool	High	High	Medium	Medium
13	Create and Establish a Tech Transfer Network	High	High	High	High

High Priority Level:

- Criteria: High Impact, High Urgency, and either Low or Medium Effort.
- Rationale: Initiatives with high impact and urgency are critical and should be addressed immediately.

Medium Priority Level:

- Criteria: Medium Impact with High Urgency, or High Impact with Medium Urgency and High Effort.
- Rationale: These initiatives are important but may require more resources.

Low Priority Level:

- Criteria: Medium Impact, High Effort, and Medium Urgency.
- Rationale: These can be deprioritized in the short term but remain important for long-term goals.

The prioritization matrix aids stakeholders in Romania's technology transfer ecosystem in strategically allocating resources and efforts where they will have the greatest impact. High-priority areas, such as developing institutional policies and strengthening collaboration with industry, are crucial for establishing a strong foundation. These actions directly influence the capacity of universities and research centers to effectively commercialize innovations. Although these areas demand a significant effort, their high impact and urgency make them essential for immediate attention.

Leveraging EU and government funding, which is both high-impact and low-effort, provides an opportunity for quick, positive outcomes with minimal resource allocation. This positions funding as a strategic priority, as it can enhance the operational capabilities of Technology Transfer Offices (TTOs) and boost innovation activities across institutions in Romania. Meanwhile, addressing the challenge of brain drain—where skilled researchers and innovators leave Romania for better opportunities abroad—requires substantial effort. However, retaining talent is vital for sustaining the country's long-term innovation potential and ensuring that Romanian institutions retain the expertise necessary for successful technology transfer.

Medium-priority areas, such as improving human and financial resources within TTOs or promoting startups through incubators and accelerators, involve greater complexity and may require a longer implementation period. Despite these challenges, these areas are important for the long-term health and resilience of the ecosystem, helping Romania strengthen its position within the regional and European innovation landscape.

Lower-priority actions, such as increasing patent output and IP management, represent areas of moderate impact that may be considered at later stages, once

foundational structures are more fully developed. While these actions are essential for sustaining a mature tech transfer ecosystem, they are less urgent in the immediate phase of development.

The SWOT analysis of Romania's technology transfer ecosystem reveals both opportunities and challenges that need to be addressed to foster innovation and economic growth. While Romania benefits from a strong academic base and access to substantial EU funding, the system is hindered by fragmented performance across institutions, a lack of cohesive policies, and limited commercialization efforts. By addressing high-priority areas such as institutional policy development, government funding, and industry collaboration, Romania can build a resilient technology transfer framework.

Leveraging available resources and taking strategic actions against threats like brain drain and economic instability will be essential to Romania's progress. Through targeted reforms and strengthened support for TTOs, Romania can enhance its technology transfer capabilities and better position itself in the European and global innovation landscape.

5 Conclusions

Romania's technology transfer (TT) ecosystem has evolved significantly since its early beginnings, shaped by various historical, political, and economic factors. While the country has made substantial progress in aligning with European Union (EU) standards, significant challenges remain that hinder the full development of a robust and efficient TT ecosystem. This section explores the key takeaways from the comprehensive study on the state of technology transfer in Romania and provides recommendations for improvement.

5.1. Strengthening Institutional Frameworks

One of the key observations from the study is that Romania's technology transfer infrastructure, particularly in universities and research institutions, is still developing.

The establishment of Technology Transfer Offices (TTOs) in major universities like the "Dunărea de Jos" University of Galați (UDJG) is a step forward in formalizing the TT processes. However, many TTOs still lack the resources and capacity to operate efficiently and effectively.

There is a need for further investment in these institutions to build the administrative and technical capacity necessary to facilitate successful knowledge transfer from academia to industry. The role of entities such as CTT-UGAL highlights the importance of creating dedicated units for technology commercialization, but the system remains fragmented.

Romania could benefit from streamlining and unifying the legal and operational frameworks governing TTOs to ensure consistency and efficiency across the country.

5.2. Challenges in Funding and Resource Allocation

A significant finding is that Romania's investment in research and development (R&D) remains well below the EU average. According to Eurostat, Romania allocated only 0.48% of its GDP to R&D in 2022, compared to the EU average of 2%. This chronic underfunding limit the ability of universities and research centers to invest in cutting-edge technology and support innovative projects. The lack of funding affects not only the research output but also the capacity of institutions to commercialize innovations.

Moreover, while Romania has access to European funding through programs such as Horizon Europe and the Regional Operational Program, low absorption rates continue to be a major issue. Bureaucratic inefficiencies, combined with a lack of administrative capacity, have prevented Romania from fully leveraging available European funds for innovation. Addressing these administrative challenges and improving fund management capabilities at the institutional level is critical for enhancing the TT ecosystem.

5.3. Regional Disparities and Uneven Development

The study identifies significant regional disparities in Romania's TT ecosystem. The Bucharest-Ilfov region, home to many start-ups and major universities, is a leading hub for innovation, benefiting from better infrastructure and higher levels of venture capital investment. In contrast, other regions, particularly in the north and northeast, struggle to attract investment and engage in TT activities. These disparities result in uneven development across the country and limit the overall national capacity for technology transfer. To mitigate these regional differences, the government should promote policies that encourage regional development. This could include providing incentives for companies to engage in TT activities in less developed areas and ensuring that all regions have equal access to funding and infrastructure.

5.4. Collaboration Between Academia and Industry

Effective technology transfer requires strong collaboration between academia and industry, yet this remains a challenge in Romania. The study highlights that universities and research institutes are often reluctant to engage in commercialization due to the risks involved and the lack of a supportive legal framework for intellectual property (IP) protection. The State Office for Inventions and Trademarks (OSIM), which oversees patent registration, is seen as slow and inefficient, discouraging researchers from pursuing patents.

Furthermore, many businesses are hesitant to invest in innovative projects due to the lack of a clear regulatory environment. Improving the legislative framework for IP protection and simplifying the patenting process would encourage more businesses to partner with universities and engage in technology transfer activities.

5.5. Opportunities in Emerging Sectors

Despite the challenges, there are significant opportunities for Romania's TT ecosystem, particularly in emerging sectors such as IT&C, renewable energy, and biotechnology. The ICT sector, which accounts for approximately 6% of Romania's

GDP, has been a driving force for innovation, with notable successes like UiPath, a Romanian unicorn in automation software.
There is also growing interest in green technologies, spurred by the European Green Deal, which aims to make Europe the first climate-neutral continent by 2050. Romania has made strides in renewable energy, with 25% of its electricity generated from renewable sources in 2021. These sectors offer promising avenues for technology transfer, especially as the country continues to align with EU climate and sustainability goals.

5.6. Building Human Capital for Innovation

A recurring issue highlighted by the study is the brain drain phenomenon, where many of Romania's top researchers and PhD graduates leave the country in search of better opportunities abroad. This has created a significant human resource gap, limiting Romania's ability to scale its innovation ecosystem. To address this, Romania needs to implement policies that make research careers more attractive by offering competitive salaries, better research infrastructure, and long-term career prospects. Investing in STEM education is also crucial for building the next generation of innovators. While Romania has excelled in international STEM competitions, there is still a mismatch between the skills of graduates and the needs of the labor market. Aligning educational programs with the demands of the technology transfer ecosystem will help ensure a steady pipeline of talent for future innovation. By addressing these challenges and capitalizing on the identified opportunities, Romania can build a stronger, more integrated technology transfer ecosystem that will contribute significantly to the country's economic development and global competitiveness. Romania's technology transfer ecosystem is still developing, facing numerous challenges but also significant opportunities. As the country continues to integrate into European and global research and innovation networks, it must improve its policies and infrastructure to facilitate collaborations between academia and industry.
To achieve this goal, Romania should: Increase public and private funding for research and development, particularly through programs that stimulate public-private partnerships; Improve research infrastructure and invest in the modernization of universities and research centers; Simplify intellectual property protection procedures and provide legislative support for the commercialization of innovations; Promote STEM education and better align educational programs with labor market requirements to develop relevant skills for innovation. By adopting these measures, Romania can develop a stronger, more competitive technology transfer ecosystem that will contribute to economic growth and sustainable development. Many universities have minimal technology transfer experience. This inhibits their ability to learn from experience and to provide role models to staff. Many universities have no spin-offs, or only negative experiences. The patenting process within universities was often described as slow and difficult. In several institutions, the inventors had to undertake the bulk of this activity themselves, competing with other demands on their time. Processes for forming spinoffs or licensing were often described as unclear. This is partially related to the rules governing spinoffs and IP ownership, described below. An empirical

study of Spanish universities found that universities with clear internal rules regarding participation in technology transfer activities and how to reconcile conflicts of interest performed better348. Several Romanian universities and institutes are in the process of adopting new rules on IP and TT or substantially revising their existing ones at institutional level.

To conclude on Romania's technology, transfer ecosystem, several key aspects must be emphasized. First, despite notable progress in aligning with European regulations and increasing investments in research and development (R&D), the ecosystem faces major challenges related to the underfunding of research, political instability, and the lack of a coherent and efficient legal framework for technology transfer. Second, the lack of effective collaboration between academia and the private sector remains a significant obstacle to the commercialization of innovations, while excessive bureaucracy discourages companies from participating in technology transfer projects.

Third, although there are successful examples, such as infrastructures like the ELI-NP Laser in Măgurele, too few innovative start-ups survive in the market due to limited access to venture capital and insufficient support services. To improve this ecosystem and stimulate innovation-driven economic growth, Romania must significantly increase public and private funding, simplify administrative procedures, and encourage public-private collaborations. Reforms in STEM education and investments in research and development infrastructure are essential to develop a workforce ready to adopt and create advanced technologies. At the institutional level, there is a clear need to improve incentives for translation for research institutes and universities, as well as building overall capacity for translation, including capacity-building for TTOs. There needs to be more stable and continuous support for TTOs going beyond the current programmes for TT entities under Regional OP, with a view to gradually move away from project-based funding, as experience from other countries in the region shows this is not an optimal model in the longer term. This is also in line with the identified need for degree of predictability in funding contained in the PSF Country Report on Romania. Thereare multiple other recommendations in the section for how to improve institutional performance, but unless there is a clear incentive for institutions, these other recommendations will likely be ineffective. One of the key reforms should focus on addressing the fragmentation of the technology transfer system, which has led to inefficiencies and a lack of coordination between key stakeholders. Creating clear implementing legislation and enhancing the legal framework for IP protection will encourage greater participation from both academia and industry in commercialization activities. Additionally, the establishment of an Innovation Agency and a National Innovation Fund could provide the much-needed financial resources and strategic oversight to drive innovation and technology transfer. Finally, by improving inter-ministerial coordination and ensuring that performance indicators are linked to financing, Romania can foster a more efficient and impactful R&D and innovation ecosystem (Bole et al., 2024).

5.7 Key Recommendations for Improvement

Increasing Investment in Technology Transfer Infrastructure – Consistent funding is essential for developing TTOs at both university and research institute levels. This includes allocating resources for skilled personnel, equipment, and facilities to support the commercialization of research outcomes.

- **Establishing a Coherent National Strategy and Policy Framework for Technology Transfer**: Romania would benefit from a clear, unified national strategy that both regulates and incentivizes technology transfer across universities and research institutes. This strategy should provide regulatory clarity, include tax incentives for companies investing in innovation, and offer targeted support programs for tech startups and spin-offs. A cohesive approach would improve coordination among research institutions, TTOs, and relevant ministries.
- **Strengthening Strategic Partnerships between Academia and Industry:** Universities should actively build strategic partnerships with the private sector through applied research projects and collaborative innovation initiatives. Forming consortia or alliances between academic institutions and businesses could facilitate technology transfer and enhance the practical relevance of academic research.
- **Increasing Investment in Technology Transfer Offices (TTOs)**: Allocating additional funding to develop TTOs at universities and research institutes is essential. Resources should focus on recruiting skilled personnel, enhancing technology transfer infrastructure, and providing specialized equipment and facilities for incubation. This investment would enable TTOs to handle IP management, patenting, and commercialization more effectively.
- **Developing Training Programs for TTO Staff**: Enhancing TTO staff skills in intellectual property (IP) management and commercialization is vital. By organizing workshops and courses, Romania can ensure that TTO personnel have the expertise needed to support patenting, licensing, and other commercialization efforts, thereby maximizing the impact of research outcomes.
- **Implementing Talent Retention Policies:** To mitigate brain drain, Romania should introduce policies that offer competitive career opportunities within the country for researchers. Retaining local talent is critical for sustaining a robust research base and ensuring that innovations contribute to national growth.
- **Promoting Academic Entrepreneurship**: Universities could encourage students and researchers to pursue entrepreneurial paths by establishing incubators and accelerator programs. These initiatives would support the transformation of innovative ideas into viable startups or spin-offs, contributing to Romania's economic and technological advancement.

Overall Conclusion

Implementing these recommendations would significantly improve Romania's technology transfer ecosystem, creating a more favorable environment for innovation and sustainable economic growth. Romania has the potential to strengthen its position within the European innovation landscape by adopting a

strategically results-driven approach, maximizing resources from European funding and international collaborations.

To contextualize Romania's position in the Southeast European technology transfer landscape, a brief comparison with Black Sea neighboring countries, such as Bulgaria, Greece, and Turkey, would be beneficial. Both Greece and Turkey have made substantial investments in their TT infrastructure, utilizing European and national funds to develop TTOs, incubators, and innovation hubs. This comparative approach can highlight Romania's current standing relative to these countries and identify specific areas for improvement.

Bulgaria also has an emerging TT infrastructure, focusing on partnerships with private industries and international collaborations to drive research commercialization. However, like Romania, Bulgaria faces challenges in funding consistency and talent retention, limiting the effectiveness of its TT initiatives. Collaborative efforts between Romania and Bulgaria could address shared challenges and create a more unified approach to TT in the region.

Cross-border collaboration opportunities between universities in Romania, Greece, Turkey, and Bulgaria could be explored, particularly in strategic areas such as green energy, bioeconomy, and information and communication technology (ICT). Such partnerships could strengthen the regional innovation and TT ecosystem, creating a common foundation for impactful cross-border research projects that benefit all parties involved.

Talent retention is another area where Romania can learn from neighboring countries. Turkey has implemented successful policies to retain researchers and innovators, which could serve as a model for Romania to combat "brain drain" and engage local talent in innovation projects. Greece has also invested in programs to reduce the emigration rates of skilled researchers. Adopting similar initiatives would help Romania maintain a stable research base, fostering continuous growth in R&D and innovation.

6 References

Agenția pentru Dezvoltare Regională Sud-Est. (2024, 10 10). ADRSE. Preluat de pe https://www.adrse.ro: https://www.adrse.ro/Planificare/Consortiu_inovare.

Bole, D. et al. (2024). Strategic evaluation of the technology transfer and IPR protection systems of Bulgaria, Croatia and Romania and recommendations for their enhancement. Eds. Kaymaktchiyski, S., Battiston, A., Jiménez, V. M., European Commision, https://ec.europa.eu/regional_policy/sources/studies/bulgarian_centres/Bulgaria_Croatia_Romania.pdf.

Cârligeanu, R. (2024). Romania's STEM Education Shines Through Global Olympiad Wins, https://blog.softbinator.com/stem-education-and-global-olympiads-romania/

Centrul de Transfer Tehnologic CENTI. (2011). Inovarea si transferul tehnologic, https://centi.ro/inovarea-si-transferul-tehnologic-instrumente-de-aliniere-a-imm-urilor-la-cerintele-economiei-de-piata.

Departamentul de Formare Continuă și Transfer Tehnologic. (2024, 10 07). dfctt.ugal.ro. Preluat de pe https://dfctt.ugal.ro/index.php/despre: https://dfctt.ugal.ro/index.php/despre.

EcoMedia. (2024). GRAFICE Investițiile de capital de risc în inteligență artificială din România au atins nivelul record de 230 de milioane de dolari anul trecut, https://economedia.ro/grafice-investitiile-in-inteligenta-artificiala-din-romania-au-atins-nivelul-record-de-230-de-milioane-de-dolari-anul-trecut.html.

EPO (European Patent Office). (2022). Patent statistics 2022. https://www.epo.org/about-us/annual-reports-statistics.html.

European Commission. (2021a). Horizon Europe: Romania's participation in the new research and innovation program. https://ec.europa.eu/info/funding-tenders/opportunities/portal.

European Commission (2021b). Green Deal: Strategia europeană pentru o tranziție ecologică durabilă. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_ro.

European Commission. (2023). Directorate-General for Research and Innovation and Hollanders, H., European Innovation Scoreboard 2023, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2777/119961.

European Comission. (2024, 10 10). https://research-and-innovation.ec.europa.eu/. Preluat de pe https://research-and-innovation.ec.europa.eu/: https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en.

European Commission, Directorate-General for Research and Innovation. (2024, July). European Innovation Scoreboard 2024 – Country profile Romania https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en.

European Investment Fund. (2022). Venture capital investments in Central and Eastern Europe, https://www.eif.org/

Eurostat. (2021). Research and development expenditure by country. https://ec.europa.eu/ eurostat/statistics-explained/index.php?title=Research_and_development_expenditure.

Eurostat. (2022a). STEM education in Europe: Trends and statistics. https://ec.europa.eu/eurostat/

Eurostat. (2022b). Rata de investiții în cercetare și dezvoltare în România. https://ec.europa. eu/eurostat/statistics-explained/index.php?title=Research_and_development_expenditure.

Eurostat.(2024), EU governments increased R&D allocations by 5% in 2023, https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240806-1.

GapMinder Venture Partners. (2022). Investment strategies and capital flows for Romanian startups. https://gapminder.vc/

Institutul Național de Fizică și Inginerie Nucleară. (2021). Proiectul ELI-NP: Lasere de mare putere la Măgurele. https://www.eli-np.ro/

Institutul Național de Statistică (INS). (2020). Indicatori macroeconomici 2017-2019. https://www.insse.ro/cms/ro/tags/comunicate-de-presa/
Institutul Național de Statistică (INS). (2021a). Contribuția sectorului IT&C la PIB. https://www.insse.ro/
Institutul Național de Statistică (INS). (2021b). Evoluția industriei IT&C în România. https://www.insse.ro/
IPSOS (2021). Românii și inteligența artificială - între ignoranță și fascinație (IRES). https://www.ires.com.ro/
KPMG. (2022). Cercetare, dezvoltare și inovare, https://assets.kpmg.com/content/dam/kpmg/ro/pdf/2022/cercetare-dezvoltare-inovare.pdf/
Kuzmenko, N. (2023). Unlocking Investment Potential: A Deep Dive into Pre-Seed and Seed Funding in CEE Countries, https://blog.privateequitylist.com/unlocking-investment-potential-a-deep-dive-into-pre-seed-and-seed-funding-in-cee-countries/
Ministerul Agriculturii și Dezvoltării Rurale. (2022). Reglementări privind emisiile de carbon în agricultura românească. https://www.madr.ro/
Ministerul Cercetării, Dezvoltării și Inovării, (2020). Strategia Națională de Cercetare, Dezvoltare și Inovare 2020-2027. https://www.research.gov.ro.
Ministerul Cercetării, Inovării și Digitalizării (MCID). (2024, 10 08). https://www.mcid.gov.ro/. Preluat de pe https://www.mcid.gov.ro/: https://www.mcid.gov.ro/sistemul-de-cercetare/infrastructuri-de-cercetare/entitati-de-inovare-si-transfer-tehnologic.
Ministerul Cercetării, Inovării și Digitalizării. (2024). POC., https://www.poc.research.gov.ro/uploads/2021-2027/conditie-favorizanta/sncisi_19-iulie.pdf.
Ministry of Research, Innovation and Digitalization. (2023). The national research-development system, https://www.mcid.gov.ro/sistemul-de-cercetare.
Ministerul Educației și Cercetării (2021a). Raportul național al învățământului superior din România. https://www.edu.ro/
Ministry of Education. (nd). The financing of higher education in Romania, official web page, https://www.edu.ro/finantare-universitar.
Ministry of Education. (2023). Order No 3721/2023 of 22 February 2023 approving the Methodology for the Financing of Academic Scientific Research in Institutions of State higher education in 2023; Issuer: Ministry of Education; (Official Gazette No 232 of 21 March 2023); unofficial translation of text
Ministerul Educației și Cercetării. (2021b). Ghid de bune practici aplicabile sistemului de CDI național în elaborarea și implementarea politicilor publice, https://sipoca393. research.gov.ro/wp-content/uploads/2021/03/Ghid-de-bune-practici aplicabile-sistemului-CDI-national-in-elaborarea-si-implementarea-politicilor-publice.pdf/
Ministerul Energiei. (2021). Surse de energie regenerabilă în România: Strategii și rezultate. https://energie.gov.ro/.

Ministerului Economiei. (2023). Strategia Națională de Competitivitate 2021-2027, https:// economie.gov.ro/wp-content/uploads/2023/06/SNC-2021-2027-anexe_2023_04_26-FINAL.pdf/

Mirea, N. et. al. (2021), Facts and figures about STEM education in Romania, https://www.researchgate.net/publication/355667152_Facts_and_figures_about_STEM_educationin_Romania/.

Nica, R., Jitaru, G., (2022). Competitive Funding for Institutional Development. The Romanian Experience Between 2016 2020; in 2022 A. Curaj et al. (eds.), Higher Education in Romania: Overcoming Challenges and Embracing Opportunities, https://doi.org/10.1007/978-3-030-94496-4_13.

Organizația pentru Cooperare și Dezvoltare Economică OECD. (2017). Regional Database. Regional Economy, https://stats.oecd.org/Index.aspx?DataSetCode=REGION_DEMOGR/.

Organizația pentru Cooperare și Dezvoltare Economică OECD. (2021). Impactul economic al pandemiei COVID-19 asupra României. https://www.oecd.org.,

Organizația pentru Cooperare și Dezvoltare Economică OECD. (2022). Tranziția digitală și impactul asupra economiilor din Europa de Est. https://www.oecd.org.

Organizația Mondială a Proprietății Intelectuale (WIPO). (2021). World Intellectual Property Indicators. https://www.wipo.int/publications/en.

Oficiul de Stat pentu Invenții și Mărci. (2024, 10 10). OSIM. Preluat de pe OSIM: https://www.osim.ro/despre-osim/link-uri-utile/centre-regionale/

Private Equity List. (2024). Investors. Romania, https://privateequitylist.com/search? country%5B%5D=Romania&stage%5B%5D=Pre-seed&stage %5B%5D=Seed&type%5B%5D=Venture+Capital+%28VC%29& name=&ref=blog.privateequitylist.com/

Rapoarte privind stadiul implementării fondurilor europene (2022). Absorbția fondurilor europene pentru inovare în România. https://fonduri-ue.ro/

Raportul Ministerului Cercetării. (2021). Evaluarea progresului în implementarea politicilor de inovare și cercetare în România. https://research.gov.ro/

Romanian Association for Technology Transfer and Innovation. (2024, 10 07). ARoTT. Preluat de pe http://www.arott.ro/: http://www.arott.ro/

Stan, M. I., & Cortel, E. M. (2022). Sustainable rural development: an assessment of citizens' perception regarding the role of the planning framework within the Romanian local communities. Technium Soc. Sci. J., 35, 1.

Stanciu, S, (2018), Aspects of Innovation and Technology Transfer in Romania, Valahian Journal of Economic Studies, 9 (23), 95-108, DOI 10.2478/vjes-2018-0021.

Statista. (2022). Venture capital investments in Eastern Europe. https://www.statista.com/statistics/venture-capital/

UEFISCDI. (2022). Document de politică publică. Propunere de măsuri și instrumente financiare pentru îmbunătățirea procesului de transfer tehnologic în Romania. București:

UNCTAD.(2021). Technology and Innovation Report 2021, https://unctad.org/publication/technology-and-innovation-report-2021.

***https://www.descopera.ro.(2018, aprilie 28). https://www.descopera.ro/istorie/17149318-1949-anul-in-care-se-formeaza-caer-consiliul-de-ajutor-economic-reciproc-100-de-ani-in-100-de-momente.