



STRENGTHENING UNIVERSITY THIRD MISSION THROUGH EDUCATION – ENTERPRISE COOPERATION: THE VALUE OF INNOVATION ECOSYSTEMS

Augustin SEMENESCU⁽¹⁾, Loredana MANASIA⁽²⁾ Mihnea COSTOIU⁽³⁾ and Elena Cristina UDREA^{(4)*}

(1) University POLITEHNICA of Bucharest, Bucharest, Romania, augustin.semenescu@upb.ro and Romanian Academy of Scientists, Bucharest, Romania

(2) University POLITEHNICA of Bucharest, 313 Splaiul Independentei, 060042, Bucharest, loredana.manasia@upb.ro

(3) University POLITEHNICA of Bucharest, 313 Splaiul Independentei, 060042, Bucharest, mihnea.costoiu@upb.ro

(4) University POLITEHNICA of Bucharest, 313 Splaiul Independentei, 060042, Bucharest, elena.faina@upb.ro

Keywords: Education-Enterprise Cooperation (EEC), university third mission.

1. ABSTRACT: The aim of this qualitative study is to provide an in-depth insight into the missions and roles of universities in socio-economic ecosystems, with a focus on the third essential direction of education: the relationship with socio-economic partners. Specifically, the paper presents the results of a research that investigated the views of purposefully selected representatives from academia, business, government and public institutions, and civil sector on education-enterprise cooperation in Romania. The research subjects followed an interview protocol, one-to-one, semi-structured interview, where they were asked a series of questions related to their perceptions, opinions and experiences regarding education-enterprise cooperation and the value of innovation ecosystems. 20 in-depth, semi-structured interviews were conducted. In order to strengthen university-business cooperation, the interviewees have suggested: developing strategic action plans to achieve the objectives of working with the university in an effective manner, supporting collaboration between academics and professionals in the socio-economic/business fields to ensure better initial and continuous education of students and graduates and the inception of funding programmes and instruments. Therefore, this research study supports, through the results obtained, the cooperation between education and businesses and provides concrete measures and actions to be taken within innovation ecosystems to boost cooperation and outcomes.

2. INTRODUCTION

European and global societies are moving, at different speeds, towards the transition to a learning society, with a logic profoundly shaped by economic, social, political and, above all, technological change. Developments in the digital sector are intensively and constantly producing change in the world of science and technology. The skill sets, attitudes and competencies that society demands are changing rapidly. In the transactional flow of innovation and social ecosystems, universities have not always been



characterised by an alert dynamic and permeability to change, which is why higher education institutions are required to respond to the need for social and individual relevance, to re-create their leadership and governance structures, to redefine their curricular architecture to respond to an alert and unpredictable socio-economic dynamic. The emergence of artificial intelligence in many professions will lead to the construction of significantly different professional development perspectives from those with which universities currently operate. As Aoun (2017) suggests, universities need to create ways of thinking that cannot be easily imitated or replicated by intelligent machines and that will enable graduates to develop careers with societal and economic impact. A robust body of research that has addressed the topic of graduate employability suggests the need to train graduates to become active participants in the learning process and autonomously co-design their lifelong learning (Foer, 2017).

Employability and career success are underpinned by the development of technical competencies, a set of transversal skills and competencies, and competencies related to innovation and entrepreneurship (Zwaan, 2017). Kamp (2019, p. 5) points out that innovation skills will be key resources for graduates of science and technology universities. In this context, universities play a key role in preparing students for a labour market that is increasingly oriented towards the transition to the 5.0 society. The knowledge society is experiencing the evolution towards a learning society in which co-participation in learning, collaborative knowledge management and information dissemination are key drivers of success.

The aim of this research is to provide an in-depth perspective on the missions and roles of universities in socio-economic ecosystems, with a focus on the relationship with socio-economic partners. To achieve this goal, the study was designed to (1) describe the types of cooperation between higher education institutions and various stakeholders in Romania, (2) identify barriers to education-enterprise cooperation (EEC), and (3) propose a comprehensive framework for identifying factors and mechanisms supporting EEC.

Specifically, the paper presents the results of a qualitative research, which investigated the views of different professional categories on optimizing cooperation in innovation ecosystems. The paper relates the third mission of universities to innovation ecosystems and discusses the specificity of the EEC in Romania, analyzing in depth the already existing experiences and responsibilities that have the potential to enhance innovation in higher education institutions and to provide concrete directions for operationalizing the EEC.

3. LITERATURE REVIEW

Higher education institutions - active players in socio-economic ecosystems

There are many reasons why universities can be considered innovation leaders. The mechanisms that interconnect these rationales are associated with the three missions that universities can assume: (1) human capital formation, understood as the primary mission; (2) contribution to the development of knowledge through research activities (second mission); (3) transfer of knowledge and technology to industry and society through technology transfer (tertiary mission). The central mission of producing knowledge in post-industrial societies has given universities an essential role in today's social dynamics. This new centrality becomes intrinsically linked to the role of orchestrating innovation networks linking multiple actors. Governments and companies view universities as responsible actors to fill in missing links, given that these organisations are impartial, have long-term strategies and are less driven by commercial interests (European University Association, 2019, p. 9). In order to fulfil this mission,



universities need to be adaptable, strategically oriented, autonomous and intensively engaged with regional and international partners. As a result of the enhanced role of higher education institutions in the socio-economic landscape, we are witnessing a reconsideration of the traditional missions of universities. Etzkowitz & Leydesdorff (2000) argue that higher education institutions, through knowledge production and technology transfer, become the engine of social, cultural and economic development. As a result, a new level of connectivity between universities, government institutions and companies is being discussed. At the level of this triple helix, a fourth category of actors can be introduced: the public, civil society, users and students, society as a whole, seen as partners in the three missions outlined above. A recent paper analysing the role of science and technology universities states that higher education institutions are acquiring a central role in the European innovation-based industry development project, taking on what the authors call mission 3.1. (i.e., open leadership with industry partners) (Bedford, et al., 2018). Successful innovation ecosystems in the future will necessarily be embedded in a globalised, interconnected context animated by collaborative relationships, where information, resources, talent and solutions have a dynamic and efficient route between locations that complement each other or develop competitive relationships, Viitanen (2016) argues. In the context of educational policies promoted at European level, the economic element is intrinsically associated with academia by reaffirming the relevance of the knowledge triangle: education, research and innovation (VDI & ASME, 2015). Europe is good at generating knowledge, but less good at turning it into innovation. Compared to the United States, European regions perform well in terms of the number of scientific publications and citations (metrics of knowledge production), but have a comparative disadvantage in transforming knowledge into innovation, as shown by several indicators, including a low number of patent applications per million inhabitants (measure of innovation) - see Figure 1.

From a public policy perspective, this reality has been addressed by initiating specific measures of a predominantly financial nature. Even though financial support for knowledge-based innovation calls for a multidimensional and complex approach, there is evidence to support that a single ecosystem actor focused approach cannot generate structural change in a short timeframe (Bedford, et al., 2018). A few examples may support the above statement: funding instruments targeted at small and medium-sized enterprises (SMEs), where the high quality of proposals has significantly lowered the success rate (European Commission, 2017); or SME funding to employ PhD graduates, which is generally implemented with very low success rates at national and regional level. In addition, ecosystem approaches have been successful practices with regional, national or international impact.

Education – Enterprise Cooperation: Challenges and Opportunities

The 4th Industrial Revolution (or Industry 4.0) is already having an effect on the labour market. Megatrends such as globalisation, digitalisation and demographic change are having a major impact on the way people work, socialise, obtain information, purchase goods and enjoy leisure time. In turn, these trends are increasingly influencing the skills people need to navigate this complexity, to cope with uncertainty and adapt to this rapidly changing landscape. The challenges are real and should not be underestimated, but there are many actions that can influence adaptation to the dynamics of the world.

Although knowledge is essential because it leads to innovation, it is not enough for a successful career. Success in future careers depends on a combination of technical skills acquired in educational programs, but to an even greater extent on a set of cognitive skills (planning and organizational skills, critical thinking and problem solving), mindsets, thought patterns and beliefs about the world (Aoun, 2017). The most important skills in engineering are: critical thinking, holistic thinking, systems thinking,



entrepreneurial thinking, global mindset, cultural agility and continuous learning capacity. All these skills cannot be imitated by (networks of) intelligent machines and are unique to humans. To these can be added other skills that can be developed within the university curriculum and that can be equally important: the ability to design, the data-driven approach, the ability to build coalitions, the ability to lead, and the ability to identify strengths and see things through to completion (Kamp, 2019). Also known as soft skills, they are commonly defined as non-technical skills that enable effective and harmonious interaction with others, are vital to organisations and can affect culture, mindsets, leadership, attitudes and behaviours. These competencies fall into the following categories: (1) advanced communication and negotiation skills; (2) interpersonal and empathy skills; (3) leadership and management skills; (4) entrepreneurship and initiative-taking; (5) adaptability and continuous learning skills; (6) teaching and training skills. They play an increasingly critical role in Science, Technology, Engineering and Mathematics (STEMpathy). In 2015, the World Education Forum organised by UNESCO, together with UNICEF, the World Bank, UNFPA, UNDP, UN Women and UNHCR, adopted the Incheon Declaration for Education 2030, setting out a new vision for education.

The 2030 Agenda for Sustainable Development is a universal and collective commitment, built as "an action plan for people, planet and prosperity" and structured around the 5Ps of sustainable development: people - the social dimension (people), planet - the environmental dimension (planet), prosperity - the economic dimension (prosperity), peace - the ethical dimension (peace) and partnership - the collective and collaborative dimension (partnership). Universities occupy a unique position in society, with a broad mission to create and disseminate knowledge, and are powerful drivers of global, national and local innovation, economic development and social welfare. As a result, universities have a key role to play in achieving the SDGs and will also benefit greatly from them.

Universities fulfil several roles in educating and training students to create a sustainable society: 1. didactic role: education contributes to the evolution of the whole human society and enables adaptation to technical transformations; 2. collaborative role: the strength of universities is the capacity for interdisciplinary research and teaching, and the challenge is to strengthen the links between research and education and between disciplines; 3. Scientific evidence-based knowledge role: universities have a key role in transmitting scientifically proven knowledge and insights; 4. Measurement and evaluation role: universities can measure the effects of different SDG-related actions; 5. Advocacy role: higher education institutions need to continuously advocate the importance of implementing the global goals. In the context of growing demand for innovation, universities find themselves in a new and challenging central position. The role of primary knowledge producer comes with demands and expectations that imply new ways of developing institutional identity. This centrality depends on responsiveness, adaptability and connectivity with both academic partners and external global and local stakeholders (EUA, 2019). Thus, entrepreneurship and innovation are important factors that create the highest added value for local and regional development, and the university that interacts, co-creates and achieves a far-reaching impact on regional, national and global development has been called a "fourth generation university". This university model involves creating its own environment both socially and economically, and in addition to its traditional educational role of providing suitably qualified human capital through teaching (the first mission), its second mission is to conduct scientific and academic research (and to base its educational process on such research) and its third and expanding mission is to create value through the transfer of knowledge and technology from academia to industry and society (Pawłowski, 2009). In this dynamic, cooperation between universities and socio-economic partners is essential. Thus, the present study aimed to investigate the state of the art of EEC in Romania.

4. RESEARCH METHODOLOGY

Participants

In order to achieve the objectives outlined in *Introduction*, 20 professionals (*Non multa, sed multum*) were interviewed, purposefully selected based on their affiliation to the following categories of organizations: academia (12 participants), business (3 participants), government and public institutions (2 participants), civil sector (NGOs, 3 participants). In terms of gender, the selected group was unbalanced (only 6 female participants). All respondents were senior professionals in their respective field, with over 10 years of work experience. 8 out of 20 participants occupy an executive position in their organizations.

Figure 1 synthesizes the socio-demographic profile of the participants affiliated to higher education institutions. Most of the participants have a solid international working experience and reported they have participated in international mobility stages, research projects and have had visiting professor or postdoctoral scholarships. One of the respondents is also affiliated with a university in the United Kingdom. Their experience in leadership positions have allowed them to carry out activities together with business stakeholders or other types of external partners.

Similarly, Figure 2 analyses the socio-demographic profile of the business representatives. Their work experiences are relevant in terms of university-business cooperation. Therefore, they have engaged in a wide range of activities with universities: talent recruitment and inception programmes for students and graduates; research and development projects jointly developed with universities, organizing academic events (e.g. conferences). The participants in this category reported themselves and their organizations as active initiators of business-university cooperation.



Figure 1: Academics' socio-demographic profile

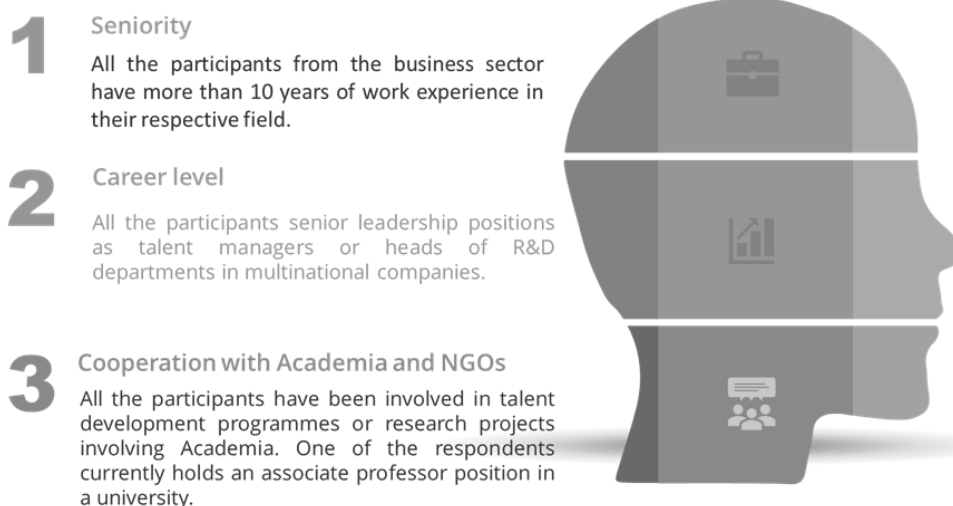


Figure 2: Business representatives’ socio-demographic profile

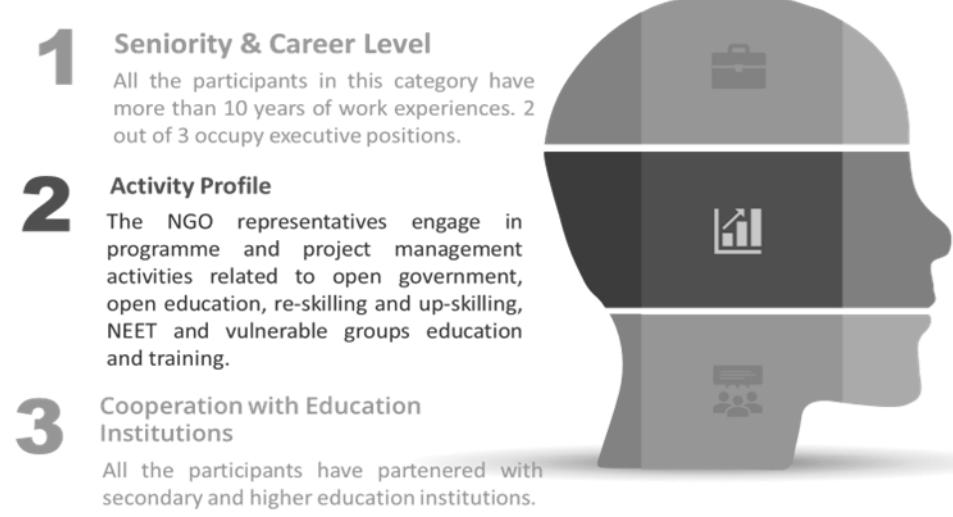


Figure 3: NGO participants’ profile

Figures 3 and 4 are summarised in this Organizations’ profile:

Type of organization	Description
University	4 universities, located in Bucharest and Cluj-Napoca: 2 technical universities; 1 economic university; 1 comprehensive university.
Private companies	3 multinational companies
NGOs	1 professional organization in the field of coaching; 1 NGO in the field of open education; 1 NGO in the field of NEET and vulnerable groups education.
Government and Public Institutions	2 ministries

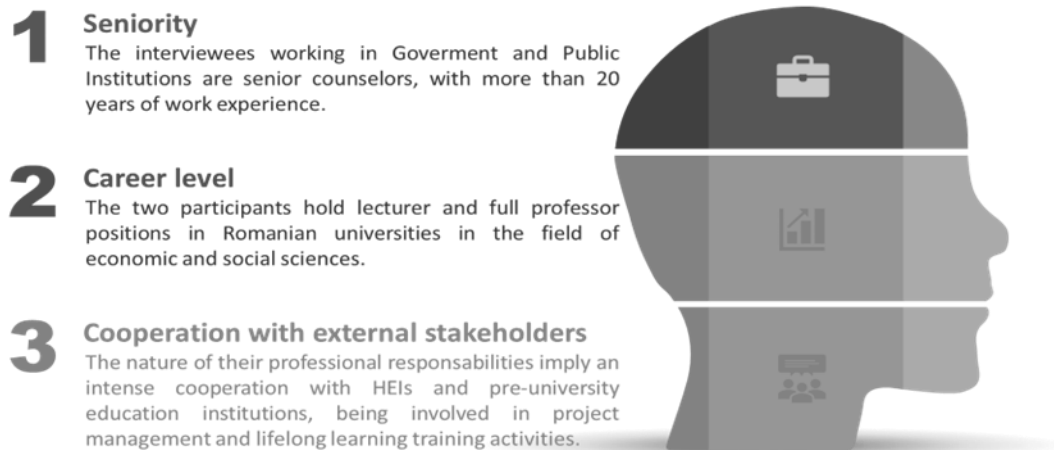


Figure 4: Government and Public Institutions Participants' Profile

Materials

20 computer-assisted, semi-structured individual interviews have been carried out between February and April 2021. The interview was based on an interview guide. The first point in the interview guide has an introductory role, facilitating the discussion. Also at the introductory stage, data were obtained on the respondent's position in the organisation to which he/she belongs, the field in which he/she works and whether he/she has work experience in other fields. The second section focused on investigating views on the EEC, followed by testing the EEC profile and collecting recommendations on the implementation of the profile at national and regional level.

Procedure

Individual interviews were organised online, using the computer-assisted web interview (CAWI) method on the Zoom platform. Before the conversation began, the researcher administering the interview introduced the interviewee to the purpose and objectives of the research and the institution under whose auspices the research is being conducted. The researchers who administered the interviews agreed in advance with the respondents when the interview would take place. Interviews were recorded, identifiers were removed from the transcript, each respondent was assigned an identification number, and responses were centralized to facilitate analysis. Prior to the start of the interview, each respondent completed an informed consent form to formally consent to participate in the research and to use the responses for research purposes.

5. RESULTS AND DISCUSSION

The extent to which EEC takes place is influenced by specific factors related to individuals, organizations, and the supporting mechanisms available at the national level. At the individual level, the interviewees reported themselves to be active initiators of EEC activities. The lack or limited availability

of organizational support and funding mechanisms limit the EEC. The absence of comprehensive policies makes individuals and organizations to focus on separate parts of the EEC process. Some of the interviewees argued for a vertically integrated approach to EEC, where three levels are defined: individuals – organizations – regions. As the interviewed representatives pointed out, EEC takes place at all three levels, but the lack of synergies is a major drawback. Moreover, the goals of the three different parties are not fully aligned. The academics argued that the universities tend to stick to long-term policies and development strategies. At the same time, the industry partners are guided by short-term strategies. In other words, there is a disjunction between stability and predictability (in universities) and flexibility and impact (in businesses).

In the following, types of EEC activities, and perceived barriers and drivers of university-business cooperation are discussed. Based on the participants’ experiences, a number of three cooperation areas have been identified in education, research and valorization of research results, and management. Given the exploratory nature of the study, these activities are inexhaustive. As all the participants argued, there is room for deepening and extending EEC in all those fields.

Table 1. Types of EEC Cooperation in Romania

EEC areas	Examples of EEC activities
1. EEC activities in education	1.1 (Paid) Internships and placements in companies and public institutions. 1.2. Curriculum co-design (e.g. designing study programmes based on specific technologies provided by industry players). 1.3. Lifelong learning programmes developed by HEIs for external stakeholders / professionals. 1.4. Co-teaching (e.g. co-lecturing, workshops organized in partnership with businesses and NGOs; joint training and open courses); 1.5. Students tutoring 1.6. Cotutelle dissertations 1.7. Recruitment activities (e.g. career fairs organized and hosted by universities, company presentations) 1.8. Scholarships for students 1.9. Student competitions
2. EEC activities in research and valorization	2.1. Joint research projects 2.2. Research laboratories supported by industry partners in universities. 2.3. Incubation labs 2.4. Providing access to research infrastructures to companies 2.4 Patents
3. EEC activities in management	3.1 Joint participation in clusters and boards

Figure 5 synthesizes the perceived barriers to university-business cooperation. Based on the participants’ opinions, five categories of barriers have arisen: (1) misaligned goals; (2) insufficient financial resources; (3) skills mismatch; (4) difficulties in partnership building, and, finally, (5) the lack of legislation. Various mechanisms and drivers have been pointed out as beneficial for EEC. The collaboration between the university and companies can be stimulated by the functioning of innovation ecosystems or regional networks/clusters/platforms integrating private companies, universities, research institutes, and NGOs. The functioning of university consortia (e.g., The Romanian Alliance of Technical

Universities - ARUT) was provided as an example for stimulating the research activity and cooperation, though having a reduced role in effective collaboration with businesses.

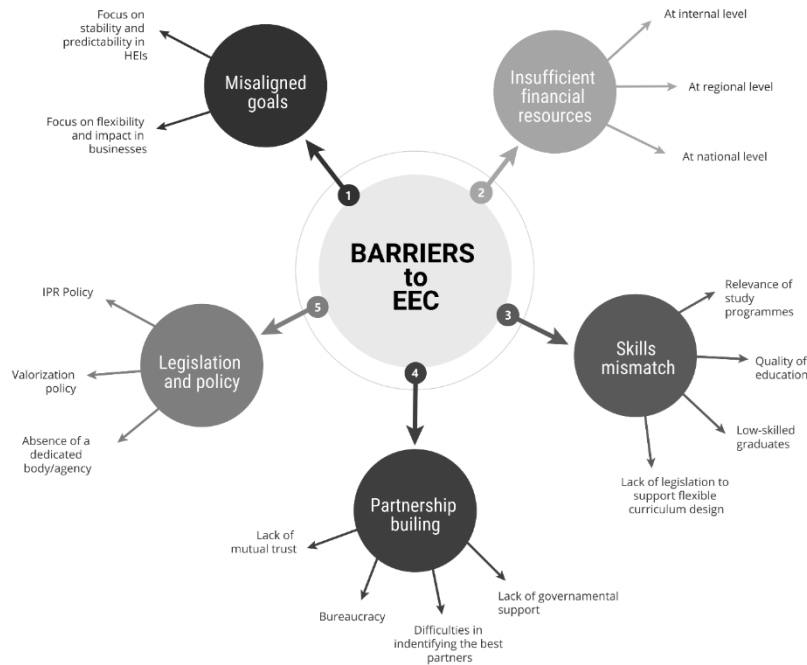


Figure 5: Barriers to Education-Enterprise Cooperation

An alternative to national consortia is international consortia and professional associations to which universities are institutionally affiliated. Participation in such networks provides access to examples of good practice and transfer of knowledge and expertise, ultimately contributing to innovation. The creation *European Universities* as a result of the European Commission's initiative is a relevant example from the perspective of innovation, cooperation policies and curriculum design.

In order to strengthen university-business cooperation, the interviewees have suggested (as shown in Figure 6):

- Developing strategic action plans to achieve the objectives of working with the university in an effective manner (valorization, legislation and policy).
- Supporting collaboration between academics and professionals in the socio-economic/business fields to ensure better initial and continuous education of students and graduates (implementation of consortia).
- The inception of funding programmes and instruments (institutional support).
- Participating in implementation innovation ecosystems.

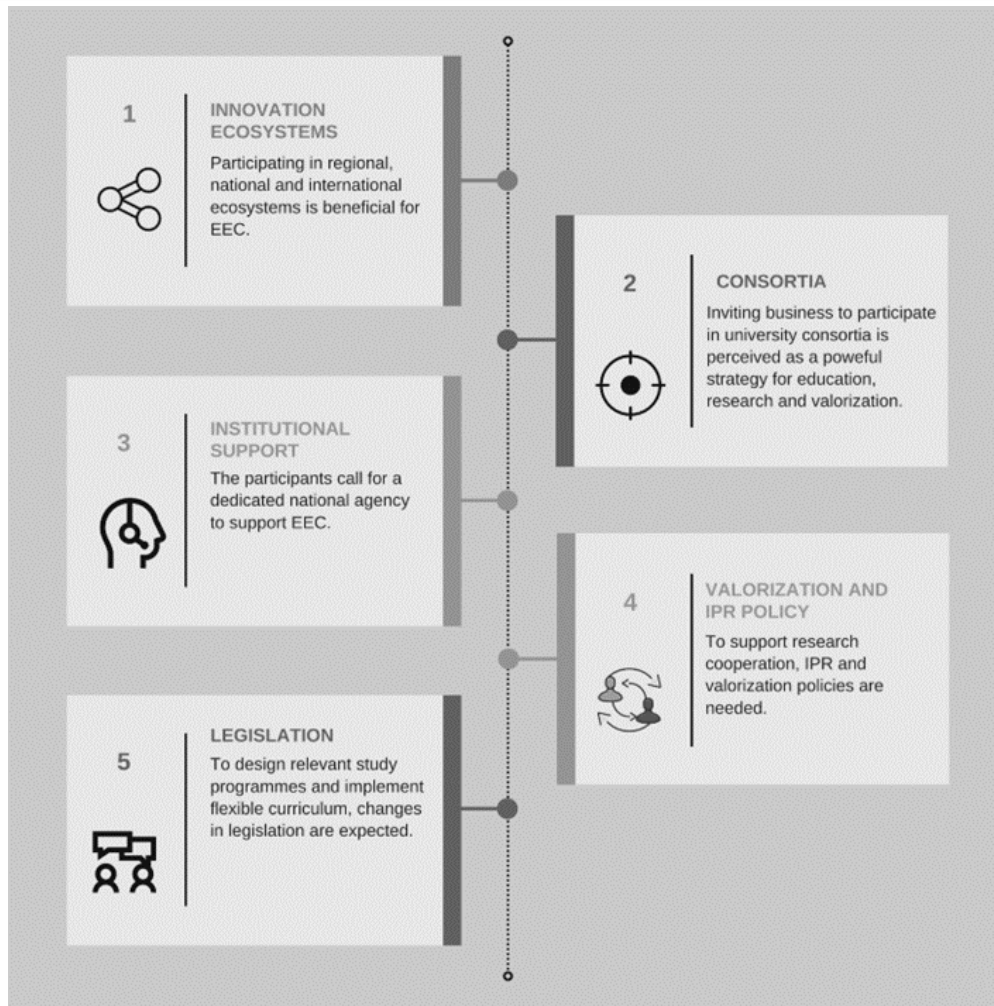


Figure 6: Drivers and mechanisms to support EEC

6. CONCLUSIONS

This study aimed at identifying and evaluating new mechanisms of strengthening EEC.

In order to make study these mechanisms, a qualitative study has been carried out to gain insights about the state of the art of EEC within Romanian innovation ecosystems.

The results showed that, given the right circumstances, EEC in Romania could positively work and have an impact on both processes (e.g., teaching and learning) and outcomes (e.g., learning outcomes). Particularly, both HEIs and businesses are starting to realize that a multidimensional cooperation could be beneficial for all parties involved. Primarily, HEIs are perceived as talent development institutions and businesses expect curricular flexibility, innovation and learning outcomes that will allow the



graduates to rapidly immerse in a new job. As expected, HEIs are not seen as innovation and entrepreneurship providers. Romanian academics are involved in a variety of cooperation activities with both private and public sector, but, in most of the cases, those are individually initiated. Thus, the respondents from Academia perceive themselves as active initiators. In this context, they identify the need for a systemic approach to business-university cooperation, financially and institutionally supported.

Some of the private sector representatives stated that they are open to partner with HEIs for local and regional development purposes. Although all the participants identified positive examples of EEC, there is not a clear commitment to building long-term strategic partnerships. The limited engagement impacts the relevance of study programmes and skills on the labor market and, eventually, graduates' employability.

The directions for engaging in partnerships with universities merit further investigation, suggesting possible short- and medium-term measures to make it work in line with the real needs and opportunities uncovered in the stakeholder consultation work.

Building on the development of the 2020 strategic collaboration with UNICEF in support of Generation Unlimited (GenU), which aims to help upskill millions of young people around the world, there is a focus on convening public, private and civil society stakeholders to develop programmes and innovations to support young people on their path to a productive future and engaged citizenship, as well as to conduct research on the global skills challenge. The jobs of the future are likely to require new skills that are harder to obtain in communities where opportunities are lacking. To help bridge this gap, this collaboration supports Generation Unlimited, a multi-sector partnership that aims to help 1.8 billion young people make the transition from school to work by 2030 - in other words, make the transition to Industry 4.0.

The 4th Industrial Revolution, or Industry 4.0 is taking effect in the labour market. This will further evolve into a "5.0 Society", where knowledge will not only be created by humans, but increasingly by algorithms in smart machines from an abundance of sensor data, thus the knowledge society is in a state of transition towards a global learning society (Aldert, Kamp, 2019).

7. REFERENCES

1. Bedford, T., Kinnaird, Y., Migueis, R., Paolucci, E., Wijlands, B., & Vos, A. (2018). Role of the Universities of Science and Technology in Innovation Ecosystems. Towards Mission 3.1. Bruxelles: CEASER Association. Retrieved from <https://www.cesaer.org/content/statements-and-publications/2018/20181005-white-paper-role-of-universities-of-st-in-innovation-ecosystems-towards-mission-3.1.pdf>.
2. Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and “Mode 2” to a Triple Helix of university–industry–government relations. *Research Policy*, 29(2), 109–123. [https://doi.org/10.1016/S0048-7333\(99\)00055-4](https://doi.org/10.1016/S0048-7333(99)00055-4).
3. European University Association. (2019). The Role of Universities in Regional Innovation Ecosystems. Bruxelles: European University Association. Preluat de pe https://www.eua.eu/downloads/publications/eua%20innovation%20ecosystem%20report_final_digital.pdf.



The International Maritime and Logistics Conference “**Marlog 12**”
Innovative Technologies for Ports and Logistics
Towards a Sustainable Resilient Future
12 – 14 March 2023

4. Kamp, A. (2019). Science and Technology Education for 21st Century Europe. <https://doi.org/10.5281/ZENODO.3582544>.
 5. Lamy, P., Brudermüller, M., Ferguson, M., & Friis, L. (2017). LAB-FAB-APP. Investing in the European future we want. Luxemburg: European Commission. Preuat de pe http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf.
 6. Pawłowski, K. (2009). The ‘Fourth Generation University’ as a Creator of the Local and Regional Development. *Higher Education in Europe*, 34(1), 51–64. <https://doi.org/10.1080/03797720902747017>.
 7. VDI, & ASME. (2015). Industry 4.0. White paper. A discussion of qualifications and skills in the factory of future: A German and American Perspective. Düsseldorf: VDI-Haus.
 8. Viitanen, J. (2016). Profiling regional innovation ecosystems as functional collaborative systems: The case of Cambridge. *Technology Innovation Management Review*, 6(12).
 9. https://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-sme_en.pdf.
-