



ENIHEI report

10 recommendations and 1 note

on innovation in European Higher Education

TABLE OF CONTENTS

1. Introduction	3
The European Network of Innovative Universities (ENIHEI)	3
About this report	3
2. Recommendations	8
#1. Support and finance higher education spin-out companies	8
#2. Promote the creation of university living labs	9
#3. Reinforce the role of universities in regional deep-tech innovation valleys	12
#4. Support the connection of innovation ecosystems around leading universities	15
#5. Train researchers to become actors of innovation	17
#6. Develop entrepreneurial talent in students	18
#7. Foster women leadership in deep-tech innovation	20
#8. Re-imagine university education	22
#9. Support teachers at all levels	23
#10. Build monitoring tools to examine the role of European higher education institutions in innovation ecosystems	25
3. A note on interdisciplinarity	27

Disclaimer

*This report is produced by the European Network of Innovative Higher Education Institutions (ENIHEI)
This is not an official publication of the European Commission. The contents of this publication do not reflect the position or opinions of the European Commission.*

*All images used in this report are from Adobe Stock Photo, downloaded under the Standard License
<https://stock.adobe.com/license-terms>*

1. INTRODUCTION

The European Network of Innovative Universities (ENIHEI)

ENIHEI is a network of higher education institutions that develops collective innovative thinking on how higher education can drive innovation. The network has currently 37 members:

- 28 members appointed by Member States
- 9 higher education institutions nominated by the European Commission

The 37 members of the European Network of Higher Education Institutions (ENIHEI) make up a forum to exchange knowledge, ideas and experiences on how higher education can promote an innovation culture, and enable creativity, entrepreneurship and talent. Its role is to:

- support the European higher education system to be up to the challenge of establishing Europe as a global leader in the next wave of innovation
- develop ideas and offer recommendations on how to advance the innovation relevant actions in the European Strategy for Universities and under the New European Innovation Agenda.

About this report

The European Network of Innovative Universities (ENIHEI) welcomes the publication of the New European Innovation Agenda (NEIA) and the opportunity to provide feedback. ENIHEI particularly values the ambitious goals and objectives set out in the document and the strong focus on implementing measures to position Europe as a globally competitive force in the innovation space.

The New European Innovation Agenda and the European Strategy for Universities recognize the fundamental contribution of higher education institutions to the European innovation landscape, providing 17.5 million people, more than one million researchers and increased licensing, patenting, and start-up activity. Universities are a distinctive feature of the European way of life,

so they must play a central role in the new wave of innovation and must be actors of change in the dual green and digital transition. Their role is crucial in fostering innovation and technology transfer, as well as in attracting, recruiting, and retaining deep-tech talent.

This report is the result of the communications presented by ENIHEI members at the first face-to-face meeting of the network held at the University of Salamanca on September 5 and 6, 2022. All the contributions, a total of 37, are included in an Annex attached to the report. Recordings of the speakers' presentations can also be viewed on the ENIHEI's YouTube channel:
<https://www.youtube.com/channel/UCoj2baEGzFgsvpeHsWn28GQ..>



This document contains ten specific recommendations to the European Commission to be taken into account in the implementation and development of the New European Innovation Agenda in synergy with the European Strategy for Universities. The recommendations are proposals based

on best practices developed by ENIHEI members and aligned with the spirit of the European Strategy for Universities and the New European Innovation Agenda.

Our proposals aim to highlight those actions that can generate the greatest impact on the higher education sector and on the European society at large. They can help the European Commission and EU member states to optimize the implementation of the policies contained in the European Strategy for Universities and the New European Innovation Agenda.

The first recommendation is related to the role of universities in stimulating entrepreneurial activities and innovation deployment through incubators and spinouts:

#1. Support and finance higher education spin-out companies

The following three recommendations derive from the value that universities bring as engines of innovation and orchestrators of their regional innovation ecosystems.

#2. Promote the creation of university living labs.

#3. Reinforce the role of universities in regional deep-tech innovation valleys.

#4. Support the connection of innovation ecosystems around leading universities.

Universities are anchors of knowledge and skills development with a pivotal role for driving innovation. In line with this important mission of higher education institutions, the report includes five recommendations on deep-talent development:

#5. Train researchers to become actors of innovation.

#6. Develop entrepreneurial talent in students.

#7. Foster women leadership in deep-tech innovation.

#8. Re-imagine university education.

#9. Support teachers at all levels.

The tenth recommendation is about improving monitoring tools for better policy making:

10. Build monitoring tools to examine the role of European higher education institutions in innovation ecosystems.

Finally, the report ends with an important note about **the need of interdisciplinarity and the importance of the social sciences, arts, and humanities**, that should be considered transversal to all previous recommendations.

This document is targeted to the European Commission to support higher education Institutions in the implementation of the European Strategy for Universities and the New European Innovation Agenda through ambitious policies and funding and through giving incentives to the national Higher Education Systems to stimulate innovation. It is also addressed to the member states of the European Union to support universities in their endeavors for deeper and more ambitious transnational cooperation by investing in the recommended innovative actions and by removing legal and administrative obstacles for international joint educational activities. This is also a call to private funding and Venture Capital investors to support university spinouts deployment and to offer funding opportunities to student and researcher innovators. We hope that this report can help the European Higher Education sector to develop a new innovation mindset. We encourage all universities to make use of existing and future opportunities offered at EU level in synergy with national/regional opportunities to reinforce their innovative activities and their transnational cooperation.

The members of ENIHEI at the time of writing this report are the following:

The University of Applied Arts Vienna (*Austria*). University of Mons (*Belgium*). UCLL University of Applied Sciences (*Bulgaria*). Trakia University of Stara Zagora (*Bulgaria*). Technical University of Gabrovo (*Bulgaria*). Zagreb University of Applied Sciences (*Croatia*). University of Cyprus (*Cyprus*). University of South Bohemia in České Budějovice (*Czechia*). University College South Denmark (*Denmark*). Technical University of Denmark (*Denmark*). Tallinn University (*Estonia*). Kajaani University of Applied Sciences (*Finland*). Aalto University (*Finland*). University of Caen (*France*). RWTH Aachen University (*Germany*). Technical University of Munich (*Germany*). Democritus University of Thrace (*Greece*). Moholy-Nagy University of Art and Design (*Hungary*).

Dublin City University (*Ireland*). Trinity College Dublin (*Ireland*). University of Brescia (*Italy*). Ca' Foscari University of Venice (*Italy*). Riga Technical University (*Latvia*). Vilnius TECH University (*Lithuania*). University of Luxembourg (*Luxembourg*). Malta College of Arts, Science and Technology (*Malta*). Erasmus University Rotterdam (*Netherlands*). Delft University of Technology (*Netherlands*). Warsaw University (*Poland*). University of Aveiro (*Portugal*). Transilvania University of Brasov (*Romania*). Technical University Cluj Napoca (*Romania*). Technical University of Kosice (*Slovakia*). University of Primorska (*Slovenia*). University of Granada (*Spain*). University of Salamanca (network secretariat) (*Spain*). Malmö University (*Sweden*).

December 1, 2022.

2. RECOMMENDATIONS

#1. Support and finance higher education spin-out companies

We welcome the initiative set out in the European Strategy for Universities for providing “European support as from 2023 - including a toolkit for universities - for the development of incubators within higher education institutions, in close cooperation with the entrepreneurial sector, to help student entrepreneurs to develop their ideas into businesses”. At the same time, the communication from the European Commission on the New European Innovation Agenda acknowledges the fact that there is a lack of Venture Capital (VC) funds for large deal values which underscores the fragmented nature of the European VC market. The lack of VC funds, specifically tailored for deep-tech start-ups is thus a serious inhibitor.

Deep-tech start-ups, which are defined as “those start-ups whose business model is based on high tech innovation in engineering, biosciences, or significant scientific advances”, more than often are seeded in ideas and concepts informed by leading edge research at world-class universities. As such it is proposed for Europe to establish in the New Innovation Agenda that the role of the university sector in facilitating the invention of new ideas and in translating these ideas into spin-out companies, led by talented entrepreneurs who have access to dedicated VC funds targeting early-stage university ventures, will be a key factor in its success.

Targeted investment in university start-ups with dedicated funds is fruitful, as has been the experience in leading research-intensive universities. More funds of this nature, perhaps as European based funds, would provide for more competition with the VCs. Funds focused on individual sectors, such as Biotech, MedTech or ICT would also be beneficial. Scale Up funds also need to be available, targeted at post Round A, when companies are looking to grow from 10 employees to 100 employees.

Historically, the lack of investment vehicles for university spinouts has been a major inhibitor to the growth of the activity. There is a growing expectation from society to deliver high quality deep-tech spinouts into the European economy. To do so, some universities have put in place their

own investment instruments to foster their own spinouts. This is the case of some Irish universities.

The University Bridge Fund (UBF), launched in 2016 was a €60m pool of capital to accelerate early-stage commercialization of research conducted in Irish universities. Trinity College Dublin (TCD) and University College Dublin (UCD) were founding members of this new investment fund with the stated aim of supporting early-stage campus company spinouts from third level institutes in Ireland through access to dedicated venture financing. Its presence has acted as a catalyst in driving high quality spin out formation resulting in Trinity creating more High-Performance Start-Ups in the last two years than in the previous ten years. In May 2021, Trinity, along with three other Irish universities, invested a further €1.7 million in the second University Bridge Fund which was to span a 10-year program with an increased target fund size of €80m [Annex, page 3].

This best practice could be replicated in many other European universities if there was a funding line aimed at promoting similar financing funds. Our recommendation, therefore, is that the European Commission include a specific action within the New European Innovation Agenda to partially finance the creation of this type of university bridge funds covering all areas of deep tech.

Recommendation #1. To support higher education institutions’ ability to create successful spin-out companies by including a specific action within the New European Innovation Agenda to partially finance the creation of university bridge funds.

#2. Promote the creation of university living labs

We live in a rapidly changing world. Qualification needs are evolving rapidly, and the higher education sector must adapt. This means modifying classic teaching structures and methodologies that have worked for a long time but now need to be updated. Among other actions, universities need to incorporate new, more flexible and interdisciplinary learning spaces. The European Strategy for Universities refers to them as "living labs": “Living Labs in universities enable students, staff and researchers to cooperate with other key stakeholders to solve societal challenges and encourages application of knowledge to the real-world context, enhances skills of

those involved, increases connections between people, and provides more opportunities to connect with society”.

These university experimentation spaces are of major importance in the development of innovation ecosystems. Some universities in the ENIHEI network present best practices, either already in operation or in the planning stage, which can be used as a reference.

The University of Applied Arts Vienna is working to establish the Knowledge Exchange Lab for Interdisciplinary Innovation (KELII). This living lab aims to be an experimentation space for interdisciplinary thought experiments, by strategically setting up structures for communication across different disciplines of knowledge and professions for synthesizing theories, ideas, approaches and experiences, in order to give incentives and provide inspiration for complex interdisciplinary innovation processes, related to the Sustainable Development Goals as well as societal and economic transformation [Annex, page 35].

Trinity College Dublin has established Tangent, Trinity’s Ideas Workspace, co-located within an expanded School of Business. Tangent is a collaborative environment for all people who are open to new possibilities. Tangent encompasses several activities that contribute to deliver economic, cultural and social value through innovation and entrepreneurship. This includes undergraduate, post-graduate and professional education, as well as student accelerators that promote student entrepreneurship [Annex, page 22].

Living labs are excellent examples of how students can be trained to work on challenges in a holistic way, across disciplines. They foster students' critical thinking, problem solving, creative and entrepreneurial skills.

Some universities have created, or participate in, living labs that place less emphasis on learning and are more focused on serving as orchestrators and intermediaries between citizens, researchers, businesses, and government agencies. They are oriented to co-creation, rapid prototyping and scaling up innovations and enterprises, providing different types of added value

to stakeholders. We can also find some examples of this type of labs in ENIHEI member universities.

The Technical University of Cluj-Napoca has been the driver of the Rural/Urban Hub of Cluj, which was designed to serve as a living lab for the European startup community to test, deploy, and validate deep technologies in real-world scenarios with real end users. The Rural/Urban hub is as an essential location for the local businesses to test and validate their ideas, gather data and information in order to build a cleaner, leaner, and greener living [Annex, page 28].



Ca' Foscari University of Venice launched VeniSIA, a program devoted to address the Sustainable Development Goals (SDGs) through a Deep Tech approach, which can be seen as a living lab for solving local problems and scaling them globally with a new perspective on acceleration-based open innovation [Annex, page 40].

The University of Primorska is involved in the Living Lab InnoRenew, which is a user-centered organization that fosters a culture of open innovation and develops new value chains and business models to meet user-identified needs. Living Lab InnoRenew provides an opportunity for members to work together to jointly develop new ideas, products, and services. [Annex, page 73].

The European Strategy for Universities states that the European Commission will mainstream 'living labs' through the Erasmus+ and Horizon Europe programs. We welcome it, but because of their potential impact on the development of the new wave of innovation, we propose that the New European Innovation Agenda also include a specific action aimed at promoting the creation of university experimentation spaces. As a network of innovative universities ENIHEI would be ready to participate in a university experimentation spaces pilot project. The call should be adequately funded and give sufficiently broad support to different types of experimentation spaces.

Recommendation #2. To set up a specific action within the New European Innovation Agenda aimed at promoting the creation of university living labs.

#3. Reinforce the role of universities in regional deep-tech innovation valleys

The EU's innovation performance improved over the period 2014-2021, but despite all efforts, regional disparities in research and innovation performance remain deep. The spread of innovations and the adoption of breakthrough technologies remains sub-optimal and there is also unexploited potential in many innovation ecosystems. A better acknowledgement of the role played by universities in innovation ecosystems and, consequently, a strengthening of their position, may help to overcome some challenges. Universities are essential as the principal source of knowledge and skills generation, and as regional economic growth engines. Many ENIHEI universities are at the core of the innovation ecosystems they belong to, the following are some examples.

Kajaani University of Applied Sciences (KAMK), for instance, has a very strong role in its regional innovation ecosystem in Finland. Its involvement broadly covers all the region's smart specialization top industries, such as bioeconomy, tourism, mining industries, measurement technology, data center operations, high-performance computing, and the gaming industry. Especially in ICT related industries, KAMK is one of the key players in innovation ecosystems. This includes an active role in RDI activities with companies, training experts and encouraging students to start new companies, and close development cooperation with research institutes and other universities [Annex, page 49].

Riga Technical University runs a Science and Innovation Center (SIC) in the Riga Technical University campus in Kipsala, which acts a one-stop innovation agency, with a highly equipped prototyping workshop and supercomputing resources. The Centre promotes knowledge transfer processes and offers services to entrepreneurs and scientific institutions, boosting the innovation ecosystem. The SIC implements activities in Latvia from four of the innovation communities of the European Institute of Innovation and Technology (EIT): EIT Climate Knowledge and Innovation Community (KIC), EIT Food, EIT Raw Materials, and EIT Urban Mobility [Annex, page 17].

The Technical University of Cluj-Napoca (TUCN) is leading the establishment of a regional, national, and international hub of scientific competitiveness and professional training in the field of hydrogen technologies applied to electric transportation by the development of a Hydrogen and Renewable Energy Research Center (H2RERC). The emphasis will be on testing and emulating solutions for fuel cell (FC) systems (as power generation/storage systems) as well as other storage systems, with renewable energy system integration [Annex, page 31].

The Malta College of Arts, Science and Technology (MCAST) brings together multiple stakeholders, such as social partners, government entities and industry representatives, under the same roof. MCAST is a partner and coordinator of two EIT initiatives, the EIT Climate-KIC Hub Malta and the Urban Mobility Regional Innovation Scheme (RIS) Hub Malta, which are a part of the Applied Research and Innovation Centre (ARIC) at MCAST and carry out innovative practices towards a net zero carbon economy across the country. MCAST is an example of how

implementing systemic strategies can lead to potential transformative policies and actions [Annex, page 54].

The Technical University of Gabrovo is a key agent in Gabrovo, one of the most important economic centers in Bulgaria with a long tradition in industry, a stable group of SMEs, a developed educational system, and high concentration of qualified and highly skilled labor force. The university, in conjunction with regional and local authorities, SMEs and mid-caps industrial representatives, runs the Regional Innovation Center “Ambitious Gabrovo” that combines the activities of an accelerator, an incubator and a co-working space, providing opportunities for the branding and internationalization of the region [Annex, page 63].

Malmö University leads the Forum for Social Innovation Sweden, FFSIS, a national knowledge and collaboration platform for social innovation. With the participation of local authorities and five Swedish universities, the FFSIS share and develop knowledge and experiences and create spaces where actors across sectors can meet and exchange ideas and best practices in the field of social innovation [Annex, page 149].

The University of Brescia is one of the drivers of The Manufacturing Alliance (THEMA) ecosystem, which aims at fostering the digital and sustainable development of manufacturing sectors in the Central-Eastern Lombardy and Western Triveneto territories by means of a close collaboration among public and private stakeholders [Annex, page 87]. In Spain, the University of Salamanca (USAL) and the University of Granada (UGR) are catalysts of their regional innovation ecosystems. The UGR-AI Project (Artificial Intelligence) aims to establish an Innovation and Digitalization Centre to serve as the hub of an ecosystem with the goal to drive the technological transformation of companies in four fields in which Granada has become an international point of reference: artificial intelligence, cybersecurity, virtual reality and 5G [Annex, page 84]. The University of Salamanca is the home of START-OLÉ and CYL HUB, the hub of innovation and technological entrepreneurship of the region of Castilla y León. This list is not intended to be exhaustive; we could find similar examples in most ENIHEI universities: Erasmus Rotterdam University in the Netherlands, Vilnius Gediminas Technical University in Lithuania, Ca’ Foscari University of Venice, Aalto University in Finland, University of Aveiro in Portugal, Transilvania

University of Brasov in Romania, Moholy-Nagy University of Art and Design Budapest in Hungary [Annex, page 6], etc.

These best practices could be replicated and encouraged if the New European Innovation Agenda sufficiently highlighted the importance of the higher education sector in fostering innovation. Therefore, it is recommended that action number 11 of the Agenda, under Flagship 3, "Establish and connect regional deep tech innovation valleys", take into account, reinforce and empower the role of Universities in the acceleration and strengthening of the European Innovation Ecosystems across the EU.

Recommendation #3. To take in account, reinforce and empower the role of universities in the establishment of regional deep-tech innovation valleys.

#4. Support the connection of innovation ecosystems around leading universities

In addition to being an essential part of the innovation ecosystems of their regions, universities can play a key part in adopting and connecting deep-tech innovation ecosystems across the European Union.

The Technical University of Munich (TUM) works to strengthen the deep-tech innovation ecosystem in the Greater Munich Area by connecting and supporting relevant stakeholders from both inside and outside academia, combining the qualities of a strong technical university with an affiliated private-sector entrepreneurship center. The shared ecosystem of the Technical University of Munich and its affiliated institution UnternehmerTUM (UTUM) is a good example of the European well-developed innovation hubs and entrepreneurship centers that are born out of strong technical universities. Founded in 2002, UTUM has leveraged TUM's efforts in inspiring entrepreneurial talent and strengthening teams to build leading global companies for 20 years now. Due to the close interlinkage with TUM, and as such with its students, scientists and professors, UTUM has unique access to new technology and talent. Vice versa, TUM benefits from UTUM's expertise and many years of experience in maturing deep-tech start-up projects. As

a publicly funded university, TUM's primary mandate is to support start-up teams in early phases, on their path towards establishing a company. UTUM on the other hand, as a private entity, can support start-ups further into their journey towards established market participants. This strategic complementarity is only one example to highlight the mutual benefits of the TUM-UTUM innovation ecosystem – which of course, ultimately, is to the benefit of TUM's start-up teams and their solutions to the big societal challenges of our time [Annex, page 70].

Another example is the Translational Hubs for Hydrogen and Next Generation Computing at RWTH Aachen University, where the transfer approach is supplemented by a new translation concept. The curiosity of the researchers, the knowledge they generate, the know-how from the industry and the required impact in industry and society are brought into a continuous, orchestrated co-working effort. Translation thus offers the opportunity to efficiently unfold research results and generate societal benefits from the hotspots of academic research.

The sort of ecosystems just described are not one of a kind, there are many more examples across Europe – one of which is DTU Skylab, the innovation hub of the Technical University of Denmark. Just like TUM and UTUM, DTU and its Skylab have had a tremendous joint evolution over the years [Annex, page 46].

Transnational cooperation is an underlying principle of the European Strategy for Universities as evidenced by its flagship initiative, the European Universities program. We endorse it and believe that transnational cooperation can take place at different levels and intensities. What is proposed here is to leverage the good practices mentioned above and to adopt and connect similar deep-tech innovation ecosystems across the EU, creating a mechanism that can

- create a European innovation initiative which builds upon the talent, technology and vast experience from existing deep-tech innovation hubs anchored around leading universities;
- scale and bridge the existing innovation ecosystems through extended and formalized collaboration across borders and thereby utilize regional positions of strength;

- create higher impact and efficiency by linking early-stage grants and investment directly to coaching, expertise and networks in the local ecosystems where the start-ups are situated;
- advance the key topics of diversity, sustainability and social innovation in the deep-tech agenda.

TUM and DTU propose to drive this development together with European partner universities. Possible points of contact include the EuroTech Alliance and the EuroTeQ Engineering University, the latter being part of the European Universities Initiative. It is proposed that this initiative could be proliferated across other European Alliance networks.

Recommendation #4. To support the connection of deep-tech innovation ecosystems across the EU by creating a European Innovation Initiative to scale and bridge existing innovation ecosystems anchored around leading universities.

#5. Train researchers to become actors of innovation

A crucial element to increase the number of deep-tech start-ups focuses on researchers who should be trained for a multitude of roles in society, including that of the entrepreneur, requiring a shift in perspective from a straightforward career track to multiple career pathways. The mechanisms by which early-career researchers find their way from academia into new ventures need to be supported and incentivized. Some ENIHEI universities have had successful experiences in this regard. For example, the University of Caen Normandie is implementing the DISC initiative to convince researchers to become actors of innovation by developing a personalized awareness/acclimation approach, through using an adapted version of the “behavioral analysis tool” methodology applied in coaching [Annex, page 136]. In early 2022, Dublin City University launched DCU Explore, a training program for researchers and academic staff based on the Lean Start-Up methodology. Lean Start-up is a scientific approach to creating start-up companies that was adopted by the National Science Foundation (NSF) in the USA under the Innovation Corps (I-Corps™) Programme in 2011 and has quickly become one of the world’s largest and most successful technology start-up accelerators [Annex, page 107]. The Centre of Competence (SMEEST) of the Technical University of Gabrovo provides business training for

researchers, including the training of specialists holding a PhD degree in priority fields. Specialized scientific training is combined with business-focused training, thus acquiring knowledge and skills on how to set up and run their own companies [Annex, page 63].

Another way to encourage researchers to take a further step towards innovation is to match entrepreneurs with university research teams. This kind of initiatives help to avoid two common constraints: a limited supply of innovative research ideas from within an institution and the scarcity of researchers willing or able to lead a new venture. It also provides the opportunity for the new venture to have a more balanced team, with the entrepreneur as CEO and the research principal investigator as CTO. A start-up with CEO and CTO fits with leading accelerators requirements that strongly recommend two co-founders for any new venture. A successful case of this approach is the Dublin City University's "DCU Fusion" program [Annex, page 109].

The above examples need to be extended to the entire European higher education sector. Research funding bodies should ensure that funding schemes supporting the employment of early-career researchers finance both research work and researcher development. The funding for researcher development should allow researchers to develop their own independent research and innovation ideas and to gain further skills apart from the research itself. Moreover, doctoral researchers should be encouraged to engage in the design of a business plan to operationalize their PhD work, such endeavors being supported by the resources of universities' Technology Transfer offices, with the goal of developing researchers' entrepreneurial skills, networking with entrepreneurs and potentially creating spin-out opportunities for deep-tech inventions.

Recommendation #5. To allocate specific resources for training university researchers in the entrepreneurial and business skills that will enable them to become agents of innovation.

#6. Develop entrepreneurial talent in students

It is necessary to insist on the development of entrepreneurial talent and to extend it as much as possible within European universities. For example, by including a basic entrepreneurial course

for all university degrees as the University of Warsaw does. Students from all departments of the university can join a course (4 ECTS) on crucial phases in all kinds of entrepreneurial endeavors [Annex, page 140]. The University of Caen focuses its efforts on the higher levels and offers a "Technology Transfer Enhancement" course at both Master and PhD levels which is specifically designed for students to acquire new business skills related to transfer and entrepreneurship [Annex, page 136]. The Technical University of Cluj-Napoca has created a toolkit for on-line and off-line education about all the stages of the development of a company: inspiration (focused on stimulating entrepreneurship), education (training and educating potential entrepreneurs), incubation (supporting entrepreneurs in the market validation towards a product-market-fit) and acceleration (upscaling and bringing the technology to market) [Annex, page 128].



The most effective programs incorporate hands-on project work where students look to turn ideas into potential start-ups. Interdisciplinary student work and project-based learning are essential

components of successful entrepreneurship education. The European Strategy for Universities recommends that such training should be focused on those required to tackle the green and digitization challenges of the future. Furthermore, it recommends that learners be exposed to start-ups and that universities should establish incubators with the goal of fostering the creation of university spin-outs by providing the hands-on experience from which relevant skills and competencies can be acquired.

The involvement of private sector innovators has proven to be a fruitful method of promoting innovation. Since 2019, Kajaani University of Applied Sciences is engaged with Demola Global Ltd, “a global community of co-creation experts, university students, and curious organizations, all driven by the desire to create impact and prepare for different futures” [Annex, page 13]. This is just an example of how innovation activities can be carried out in a wide network of higher education institutions in cooperation with companies.

Recommendation #6. To put special effort and resources on the development of the entrepreneurial talent within university students with special focus in project-based learning and collaboration with companies.

#7. Foster women leadership in deep-tech innovation

As the European Strategy for Universities states, there are persistent gender gaps in higher education with large gender differences across fields of study. In the STEM fields, women still represent slightly less than a third of students at bachelor and master level, and 37% of doctoral candidates. Many universities have actions devoted to attract young high school students to STEM careers, like the initiative “Quiero ser ingeniera” of the University of Granada that is specially oriented to attract female students to engineering degrees [Annex, page 84]. However, more initiatives supporting women to follow prospective career paths in technology should be promoted.

From an entrepreneurial point of view, although the proportion of women starting businesses has increased in recent years, the rate of entrepreneurship is still higher for men than for women. In

the EU, the women's entrepreneurship rate is half that of men, and despite the wide variation in the rate of self-employment across EU countries, this inequality is present in all member countries. Likewise, the underrepresentation of women in the European Venture Capital (VC) landscape represents a major constraint to the development of a strong innovation ecosystem. Based on data from 2020 and 2021, a significant gender financing gap has been spotlighted in the European VC markets. In 2020, only 1.7% of the capital raised in European VC markets was captured by tech companies led by female founders. In 2021, male-only firms accounted for about 90% of capital and 84% of deals concluded, against 1.1% of capital and 5.4% of deals reported for women-led companies. The gap remains in the spotlight when considering companies with male-female co-founders, which captured only 8.8% of the capital raised in 2021. The University of Primorska suggests that the European Commission should more explicitly consider one of the main problems women face during their career: maternity leaves. This issue is also raised within Sustainable Development Goal 5 and requires more gender balance, given that the EU average inactivity rates due to caring responsibility in 2018 stood at 31,7 % for women compared to 4,6 % for men (out of inactive women/men aged 20-64). It is well known that the EU is working on this discrepancy in general terms (no matter the industry, sector or field). However, given that the deep-tech sector is one of the fastest-growing and developing fields, it is suggested that the New European Innovation Agenda expresses some additional support for women entrepreneurs in deep-tech in case of caring responsibilities [Annex, page 82]. It would be very beneficial to motivate women to remain in the industry and continue their careers in the deep-tech business.

Piloting a Manifesto for Women in Tech has been proposed as a key measure within the Gender Equality Strategic Plan of the Technical University of Cluj-Napoca. This was scaled up as a flagship initiative, under the EUt+ (European University of Technology) alliance, framing the EUt+ mission towards a model of good practices for institutional integration, inclusion, and regional connectivity. The commitment of the 8 consortium partners on May, 19th, 2022 promoted its adoption as a core value of the EUt+ identity and it recognized it as a flagship action to support a human-centered model of technology. The presence of women in the Tech sector has been approached from 8 perspectives including: female entrepreneurship, rewarding and financial compensations, work-life balance, gender equality, organizational culture, transparency and

fairness in promotion, and reintegration in the work environment after long-term breaks [Annex, page 124]. It is suggested that this initiative be extended to the European level.

Recommendation #7. To work in close cooperation with universities, relying on the above initiatives and suggestions, to encourage women entrepreneurship and leadership in deep-tech innovation.

#8. Re-imagine university education

What does a high-quality education constitute? Is the higher education model that pervades Europe the optimal structure within which to nurture and develop deep tech talents? A movement is taking place in the higher education sector for the development of new degrees designed towards future-oriented disciplines. As an example, Dublin City University is developing the initiative DCU Futures. It is a €19.9 million project that involves the development of ten new undergraduate degree programs and specializations, that consider both the overarching objectives of the twin green and digital transitions and the need to develop graduates with human-centric skillsets who will thrive in an increasingly automated environment [Annex, page 98]. New degrees are either the next evolutions of existing disciplines, e.g. a BSc in Chemistry with Artificial Intelligence, or newly emerging interdisciplinary spaces, e.g. a BSc in Psychology and Disruptive Technologies. Many universities are updating their master's degree offerings along the same lines: a new Masters in Artificial Intelligence for Industry 4.0 at the Malta College of Arts, Science and Technology (MCAST) [Annex, page 117], a Radiogenomics Master at the University of Warsaw to educate experts with interdisciplinary skills in the field of natural sciences, medicine, and pharmacy [Annex, page 142], etc. An effort is needed at the European level to disseminate best practices and to shape the evolution of the entire higher education system.

It is also necessary to increase the percentage of graduates in deep-tech fields. Tallinn University proposes the creation of new study areas that can function as entry points to STEAM fields. Study areas that cater both to the students' interests (for example, in media) and the ICT fields at the same time, while also being the source of divergent thinking and transdisciplinary competences conducive to innovation [Annex, page 122].

At the same time, the traditional higher education learning methodologies are being challenged. Dublin City University advocates Challenge-Based Learning (CBL) and the development of the students' transversal skills. CBL is a methodology that actively engages students in a situation that is real, relevant, and related to their environment. Malmö University argues that with a CBL approach, Higher Education Institutions will actively contribute to the building of a sustainable learning society through collaboration in education, research, and innovation [Annex, page 153]. CBL involves students working with stakeholders to define a challenge and collaboratively develop a solution that is environmentally, socially, and economically sustainable. A key challenge is to equip academic staff with the skillset to effectively support students. Among the transversal skills, a crucial one is that of digital and data literacy. All European university students, regardless of their degree of study, should acquire a core digital literacy skillset to fully understand the global digital transformation and to enable effective communication across sectors.

The contents that European university students study and the way they study those contents are the foundations on which the development of the European innovation ecosystem is based. They are at the heart of the intersection between education and innovation.

Recommendation #8. To support the higher education sector in the development of future-oriented new degrees and stimulate pedagogical innovation disseminating best practices.

#9. Support teachers at all levels

It is necessary to ensure that NEIA actions are spread throughout the European education system and are not limited to a few large projects that play a minor role for a few people, thus limiting the scope of the new wave of innovation. This requires reaching out to and involving teachers at all levels of education.

First and foremost, university faculty. We welcome the fact that the European Strategy for Universities recognizes the need to address academic careers and that the Commission will propose, by 2023, a European framework for attractive and sustainable careers in higher

education. We recommend considering the existing experiences of ENIHEI universities, such as the Tansilvania University of Brasov (UNITBV) strategies for fostering, attracting and retaining talent [Annex, page 132]. Talent cultivation at UNITBV includes rewarding talents with performance-based salaries, support for international mobility and university funded research projects. In general, we agree with the need of flexible and attractive academic careers, that value teaching, research, entrepreneurship, management, and leadership activities. Faculty must be supported so that they can keep up the pace. The necessary changes in teaching methodology mentioned above require an upskilling of faculty that demand the allocation of adequate resources.

But innovation in all aspects needs to be integrated into all educational levels. Universities educate teachers for primary and secondary levels to give school pupils an understanding of the world of work which changes rapidly. Research has shown that bringing innovation into the classroom fosters interest and awareness of the opportunities in STEM and gives the pupils a stronger knowledge of the various careers that are emerging out of the green and digital transition. To increase the share of graduates in fields related with deep-tech requires heavy investments in the research and implementation of the newest STEAM didactics in public schools [Annex, page 122].

The University College South Denmark and other Danish universities have gathered national experiences within two areas of STEM that can be replicated in Europe:

- Playful learning: A national program funded by the Lego Foundation and launched in 2018 with the vision to strengthen children’s creative, experimental and playful approach to the world while also nurturing and fostering a lifelong desire to learn.
- NAFA, the Danish Academy of Natural Sciences, supports motivating science teaching in primary schools through improved science teaching at the Danish universities of applied sciences. The purpose is to ensure that students can translate science knowledge into concrete actions that meet the societal changes and challenges.

Teachers are the gateway to foster talent early on. Actions such as the above aimed to strengthen the teachers’ role can be upscaled to a European level if there is a targeted budget in Horizon

Europe to identify current gaps in the teachers' profession as well as a call to support the continuation of the Erasmus+ Teachers Academies.

Recommendation #9. To encourage and support teaching careers and innovation in teaching methodology at all educational levels, both for university faculty and for primary and secondary teachers.

#10. Build monitoring tools to examine the role of European higher education institutions in innovation ecosystems

As the New European Innovation Agenda states, effective innovation policies must be based on accurate monitoring and evaluation. Policies, both EU and national, must keep pace with the changing nature of innovation.

Currently, the Research, Development and Innovation (RDI) metrics often describe the contributions and outputs of research and its financing, publications and IPR activities. High-quality Eurostat statistics cover RDI extensively. The statistics fall into four main categories:

“Research and development (R&D) include statistics on expenditure, personnel and government budget allocations for R&D. Data are available by performing and funding sectors, types of costs or economic activities.

- Community Innovation Survey provides statistics about enterprises that have product and business process innovations, their strategies, knowledge management and innovation activities, as well as about factors that facilitate or hinder innovation ('innovation environment').
- High-tech includes statistics on high-tech industries and products, high-tech trade as well as knowledge-intensive services.
- Human resources in science and technology (HRST) includes statistics on the current stock of HRST and on the current and future supply of highly skilled persons.” (Eurostat, 2022).

These statistics measure the EU's and the member states' performance in RDI. However, they do not measure the more complex effects arising from the interaction of companies, universities,

and public actors in innovation processes and in innovation ecosystems. Therefore, it is proposed to build and test monitoring tools that can be used to examine innovation ecosystems and their operation in more detail. In particular, the role of European higher education institutions in the innovation ecosystem should be examined. This proposal comes from the Kajaani University of Applied Sciences and relies on a study carried out by the Federation of Finnish Enterprises, Finnvera Plc and the Finnish Ministry of Economic Affairs and Employment. The survey included, for the first time, questions regarding the cooperation of small and medium enterprises with higher education institutions and research institutes. By mirroring the methods and results of this study, we can develop monitoring tools for innovation ecosystems [Annex, page 145].

The proposal is using the ENIHEI network for the development of RDI policy monitoring metrics and data collection in such a way that we can sufficiently grasp the effectiveness of policies supporting the development of ecosystems and measure the importance of ecosystems. This proposal will contribute to the development of robust data sets that can inform innovation policies at all levels across the EU and also could be linked to the European Higher Education Sector Observatory that the European Commission will set-up in 2023 as part of the European Strategy for Universities.

Recommendation #10. To build and test monitoring tools that can be used to examine the interactions within innovation ecosystems and, in particular, the role of European higher education institutions in these ecosystems.

3. A NOTE ON INTERDISCIPLINARITY

The International Science Council recently published a report titled "Unleashing Science: Delivering Missions for Sustainability", emphasizing the need for "stimulating innovation through collaboration across disciplines" [Annex, page 38]. The report points out that we have to "understand and frame current global challenges as intertwined natural and social problems, and therefore give prominent leadership roles to the social sciences, arts and humanities, without negating the important contributions from physical, natural, engineering, medical and other applied sciences".

Social sciences and humanities are indispensable to understanding and addressing complex societal challenges and to grasping the emerging opportunities that technology offers. A fully effective implementation of technological responses to global challenges or to newly recognized opportunities requires a profound understanding of human needs, values, motivations and behaviors. The effective use of new technologies (as diverse as genetic engineering, nuclear power, stem cells and cyber monitoring systems) all depend on community acceptance, community understanding, and the willingness of individuals to change their behaviors. These require an awareness of what, how and why people believe, behave and change – an awareness that only the Social Sciences and Humanities can produce.

Likewise, the contribution of the arts is essential. In the current global situation, the creative synthesis of knowledge is now at least as important as its multiplication. Creating unusual connections, changing perspectives, working with uncertainty, unpredictability and ambiguity; this is why we also need the wisdom of art in the process of social innovation in times of radical upheaval. The arts cannot change the world, but they can help change people's mindsets. And it's people with the right mindset who can change the world.

Due to the dominating academic traditions and structures, the vast majority of researchers and students act in a system which is fragmented and departmentalized. This makes it more and more

difficult for universities to contribute sufficiently to solving the complex global challenges which require a mindset based on a cross-disciplinary and non-linear understanding of reality. Communicating, thinking and acting across disciplines and professions needs to become a common working method at universities – without negating the importance of single disciplines. It is strongly recommended to create effective structural incentives for renewing the academic mindset towards accepting and practicing serious communication across disciplines. This is the main challenge that we need to overcome to be able to reach a truly new wave of innovation and implement new innovative structures around research, education and collaboration with all sectors of society to promote innovation in a broad perspective. Applying both scientific specialization and strategically organized interdisciplinary communication, will enable Europe to meet the complex global challenges and to succeed in the competition with the USA and China for innovative strength and thus for societal prosperity.



European Network of Innovative Higher Education Institutions (2022). *ENIHEI Report: Ten recommendations and one note on innovation in European Higher Education*. ENIHEI. <https://education.ec.europa.eu/education-levels/higher-education/innovation-in-education/european-network-of-innovative-higher-education-institutions>



- | | |
|--|--|
| 1. University of Applied Arts Vienna | 18. MOMÉ Moholy-Nagy University of Art and Design Budapest |
| 2. UCLL - University of Applied Sciences | 19. Dublin City University |
| 3. University of Mons | 20. Trinity College Dublin |
| 4. Technical University of Gabrovo | 21. University of Brescia |
| 5. Trakia University of Stara Zagora | 22. Ca'Foscari University of Venice |
| 6. Zagreb University of Applied Sciences | 23. Riga Technical University |
| 7. University of Cyprus | 24. Vilnius Gediminas Technical University |
| 8. University of South Bohemia in České Budějovice | 25. University of Luxembourg |
| 9. University College South Denmark – UC SYD | 26. Malta College of Arts, Science & Technology |
| 10. Technical University of Denmark – DTU | 27. Erasmus University Rotterdam |
| 11. Tallin University | 28. Delft University of Technology |
| 12. KAMK Kajaani University of Applied Sciences | 29. University of Warsaw |
| 13. Aalto University | 30. University of Aveiro |
| 14. Université Caen Normandie | 31. Transilvania University of Brasov |
| 15. RWTH Aachen University | 32. Technical University Cluj Napoca |
| 16. Technical University of Munich | 33. Technical University of Košice |
| 17. Democritus University of Thrace | 34. University of Primorska |
| | 35. Universidad de Granada |
| | 36. Universidad de Salamanca |
| | 37. Malmö University |