EIT HEI Initiative

Innovation Capacity Building for Higher Education

European Institute of Innovation & Technology

Funded by the European Union

WP4. White paper

Collaboration between academia and businesses

ABCD Deep Tech Project

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ABCD DEEP TECH

Supported by Climate-KIC

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Executive summary

The key objective of the WP4 field survey of the ABCD consortium is to map the current situation related to deep-tech ecosystems by reviewing the contribution of universities to deep-tech start-ups through four dimensions: (i) people, (ii) science & technology, (iii) university systems and (iv) ecosystems. The survey, conducted online during October-November 2023, was answered by 74 deep-tech business representatives, NGOs and public bodies from North Macedonia, Montenegro, Bosnia and Herzegovina, Serbia, Hungary and Albania.

The respondents favourably appraised the pool of talents that can be recruited from universities in terms of digital skills, relevant subject area knowledge and work dedication. In addition, they ascertain that academic research and researchers that can be utilised in their work when it comes to applicable research and consultancy services. Moreover, universities are keen on supporting innovation and start-ups/scale-ups in deep-tech through cooperation and exchange of best practices as well as by providing access to the ecosystem of successful start-ups mentoring networks, customers and investors.

Nonetheless, the survey feedback indicates that the current level of collaboration between organisations that support deep tech and Universities can be enhanced. The pinpointed engagement activities encompass Applied Research Collaboration, Mentorship, Workshops, Networking (by using the connections to reach potential international collaborators of deep tech ecosystem), Policy and Strategy Development on fostering The Quadruple Helix Model of Innovation Dynamics that unites government, academia, community and industry.

Promoting and enhancing collaboration between universities and deep tech organisations can be mutually beneficial, fostering innovation, research, and talent development. As a result, the respondents accentuate the need for University Business Cooperation (UBC) in the domain of Education, Research, Commercialization and Combined governance.

1. Introduction

Given the importance of knowledge-exchange relationships, the University Business Cooperation (UBC) Strategy has implications for both academic institutions and companies in deep tech. These relationships can be the foundation of a knowledge society, innovation and talent development. As such it can benefit both the HEI (Higher Education Institutions) sector and the companies. Collaboration between the university researchers and practitioners can relay a multi-layered impact:

Deep tech companies can exploit the knowledge and technology transfer from academia through common projects and endeavours.

HEIs will benefit from collaboration between academics and practitioners by embracing the creation, development and transfer of academic deep-tech innovations to the marketplace. This strategic positioning will make HEIs the driver of deep tech solutions.

Students will be mentored by knowledgeable industry mentors on the entrepreneurial ecosystem and encouraged to develop an entrepreneurial mind set by participating in start-up ventures with the goal of developing their own deep-tech companies and solutions.

Lastly, the academic and non-academic staff at HEIs will acquire the skills needed to actively contribute to economic, technological and social developments by moulding human and business capital.

Having in mind the envisioned goal to work on the ecosystem development strategy in a later stage, we first embarked on mapping the current stage of deep-tech start-ups and ecosystem in the home country (including the businesses and prototyping services and infrastructures). The mapping of key issues, motives and challenges took place by conducting an online survey with key deep-tech business representatives. As a result, this white paper report depicts the current stage of deep tech start-ups and the ecosystem. In addition, this report provides the foundation for the three pillars set by the Consortium:

1. To indorse integrated pedagogy by studying and offering solutions that promote research, development and innovation collaboration within the ecosystem.

2. To inspire students and academia to combine theory and practice by working on real life problem projects proposed by partner deep tech businesses.

3. To encourage student entrepreneurship with an active and result-oriented approach within selected courses through projects integrated with the academic curriculum.

2. Survey methodology

The survey was distributed online during the months of October and November 2023 by the 6 partner universities from the ABCD consortium: University American College Skopje, University of Montenegro, University of Sarajevo, Belgrade Metropolitan University, Budapest Metropolitan University and the Polytechnic University of Tirana. The questionnaire addressed target respondents from the universities' countries: North Macedonia, Montenegro, Bosnia and Herzegovina, Serbia, Hungary and Albania, respectively. Target respondents were representatives of private entities, NGOs and public bodies from the deep-tech ecosystem, with headquarters or representative offices in the country of the respective university.

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The questionnaire consists of 13 questions. It opens with general questions on the organisation's country of origin, legal form, age, size and deep tech focus. The next 5 questions seek to explore various aspects of the University Business Cooperation (UBC), starting with recruitment, joint research, innovation support, current deep-tech UBC level and collaboration practices. The questionnaire ends with an enquiry on the willingness of the respondent to become member of The Alliance of Boundary Crossing for Deep Tech project, potential coop areas, and suggestions on better promotion of the University Business Cooperation in deep tech.

3. Survey results

The survey was answered by 74 organisations from North Macedonia, Montenegro, Bosnia and Herzegovina, Serbia, Hungary and Albania. The responses to the 13 questions are depicted below.

1. Please specify the country of origin for your organisation:

Figure 1 Country of origin of the organisation

The majority of the responding organisations are headquartered in Montenegro and Albania (24 and 23 percent respectively), followed by Serbia (18 percent), Bosnia and Herzegovina (15 percent) and North Macedonia (15 percent). The remaining four have their head offices in the United States, Switzerland and Hungary.

2. Please indicate whether your organisation is a Company, Public body, NGO, or other:

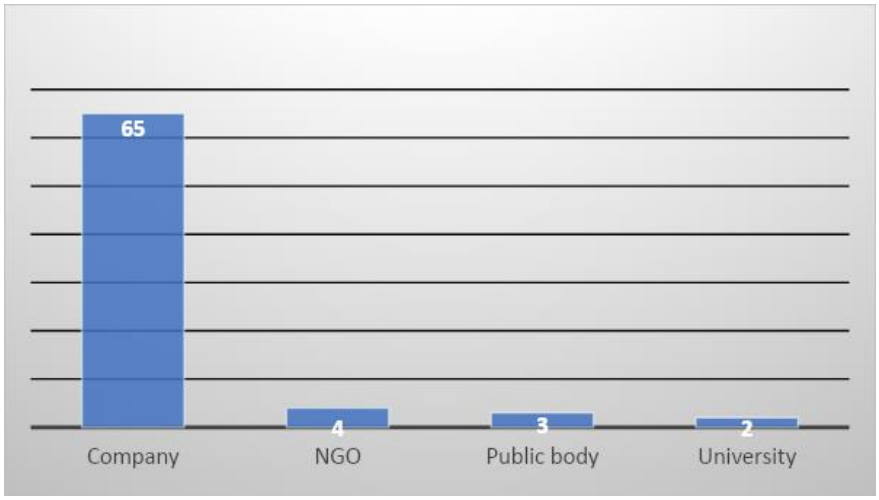

Figure 2 Organization type

88 percent of the survey respondents come from companies (88 percent or 65 respondents). The remaining 12 percent (9 responses) are from NGOs, public bodies and universities.

3. How long does the organisation exist?

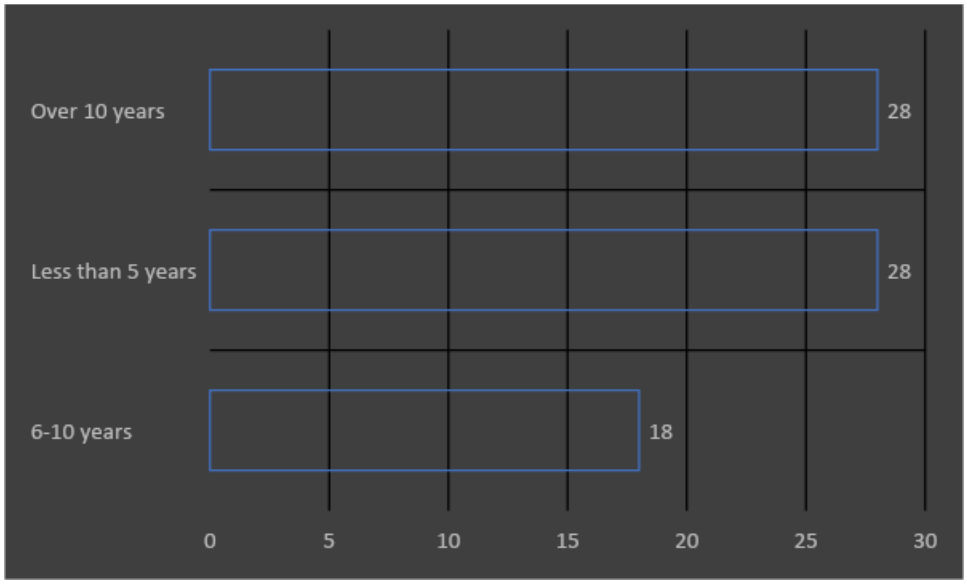

Figure 3 Organization age

62 percent of the organisations (i.e. 46 entities) exist for more than 6 years. 28 organisations are relatively younger as they have been founded less than 5 years ago.

4. How many employees does the organisation have?

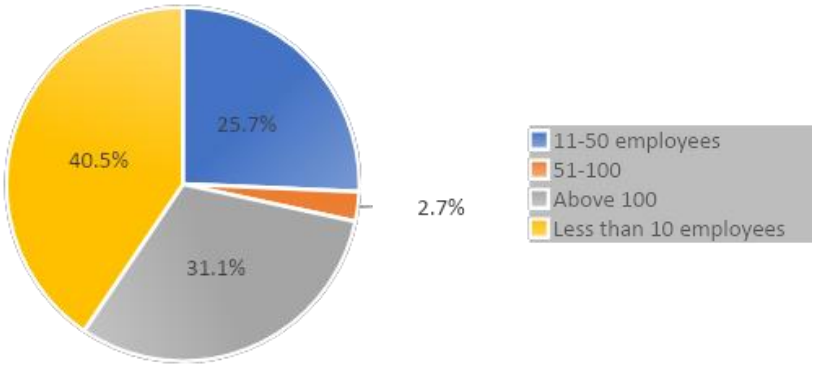

Figure 4 Number of employees

When it comes to the workforce, the majority of the responding organisations are small and have less than 10 employees (40.5 percent). 31.1 percent employ more than 100 persons, 25.7 percent have 11-50 employees, while the remaining 2.7 percent employ between 51 and 100 individuals.

5. Please select which of the following deep tech areas you are focusing on as an organisation?

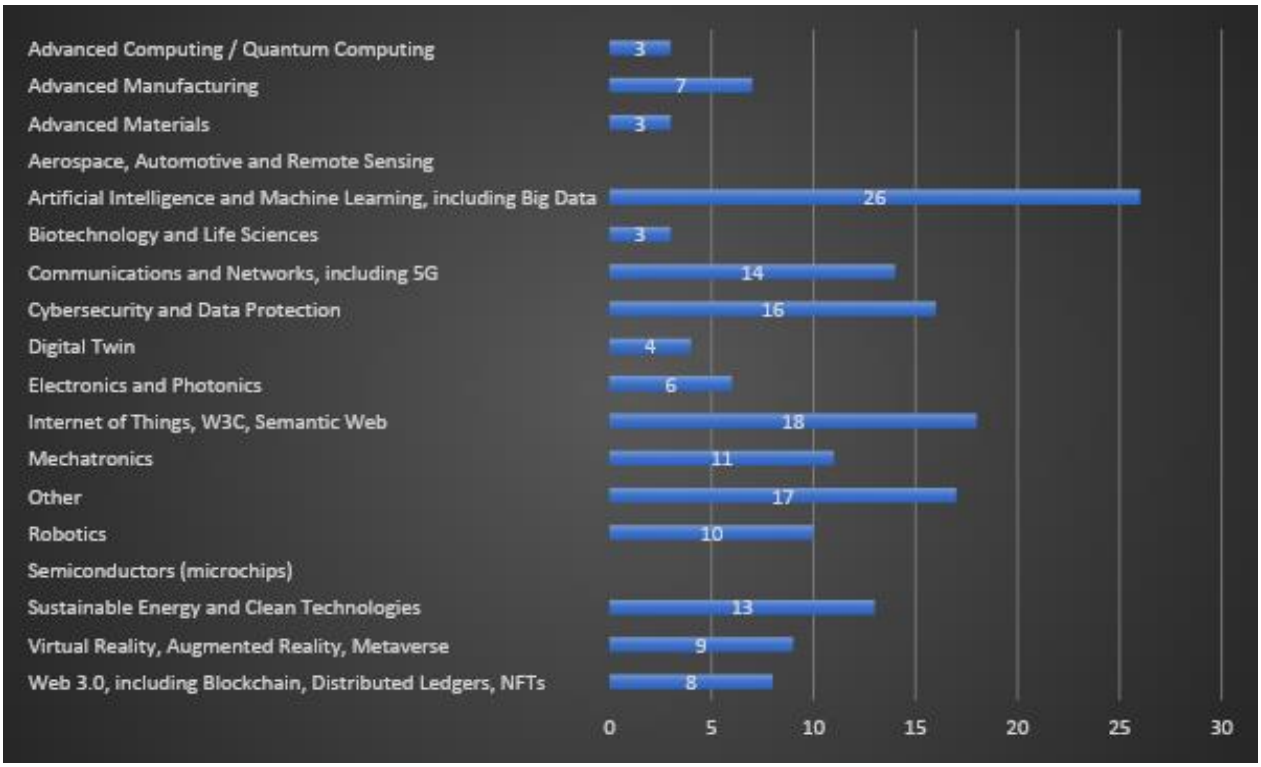

Figure 5 Deep tech area focus of the organisation

The respondents could select multiple answers should their organisation be involved in more than one area of relevance for the current study. The options provided encompassed Advanced Computing / Quantum Computing; Advanced Manufacturing; Advanced Materials; Aerospace, Automotive and Remote Sensing; Artificial Intelligence and Machine Learning - including Big Data; Biotechnology and Life Sciences; Communications and Networks - including 5G; Cybersecurity and Data Protection; Electronics and Photonics; Internet of Things, W3C, Semantic Web; Robotics; Mechatronics; Digital Twin; Semiconductors (microchips); Sustainable Energy and Clean Technologies; Virtual Reality, Augmented Reality, Metaverse; Web 3.0, including Blockchain, Distributed Ledgers, NFTs. At the end of the question, the respondents were given the option to add additional areas if not specified in the list.

The majority of the respondents are involved in Artificial Intelligence and Machine Learning, including Big Data (15.5 percent), followed by Internet of Things, W3C, Semantic Web (10.7 percent), Cybersecurity and Data Protection (9.5 percent), Communications and Networks, including 5G (8.3 percent), and Sustainable Energy and Clean Technologies (7.7 percent).

The other deep tech areas of focus by the survey participants (10.7 percent) included Economics; Trust services, eID, remote signing, digital wallet; Applications and tools for payment industry; Soft skills and

AI; Managed IT Services and Web Presence; Outsource in Information Technologies; Software Engineering and Information Technology; Consulting and Education; Entertainment movie industry; Microsoft 365 and Dynamics 365; Research & Innovation policy; Software development and data analytics; Technical solutions for the industry of tourism; and Web, mobile software design and building.

6. Please appraise the following aspects related to the pool of talents that can be recruited from universities:

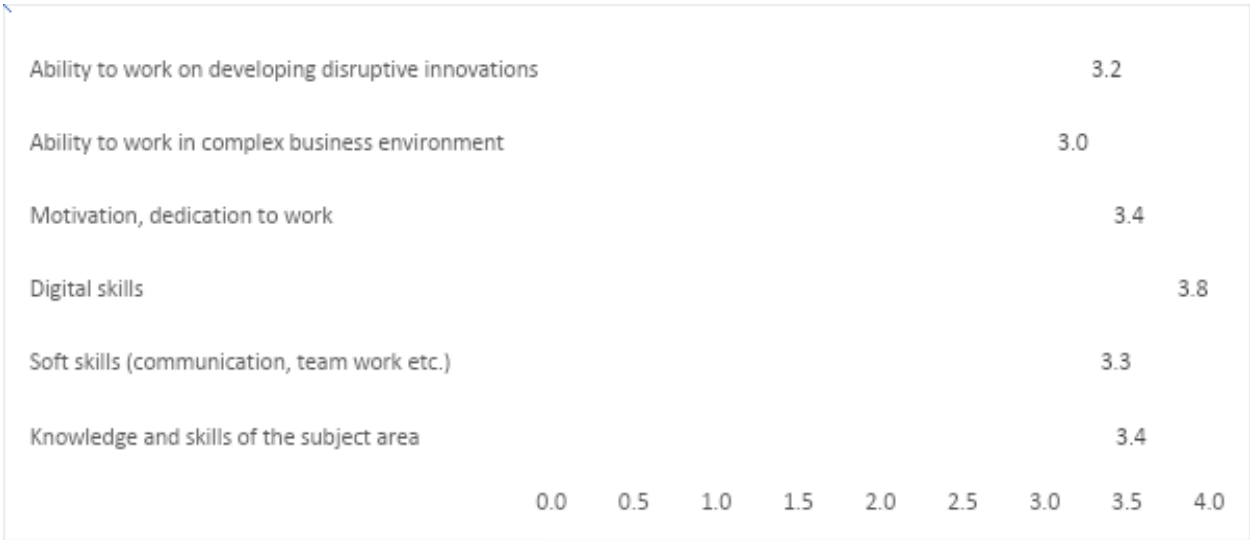

Figure 6 Appraisal of the pool of talents that can be recruited from universities

The respondents were asked to appraise the pool of talents that can be recruited from universities ranging from 1 (very unsatisfied) to 5 (very satisfied).

The highest average rating was attributed to Digital skills (mean of 3.8), followed by Motivation, dedication to work and Knowledge and skills in the subject area (both with a mean of 3.4). Soft skills in regard to communication and team work followed closely (mean of 3.3). Ability to work on developing disruptive innovations as well as Ability to work in complex business environments received lower valuations (mean of 3.2 and 3.0 respectively), indicating a somewhat lacking preparedness of students to tackle innovation that creates a new market and value network and to quickly adapt to complex business settings.

7. Please appraise the following aspects related to academic research and researchers that can be utilised in your work:

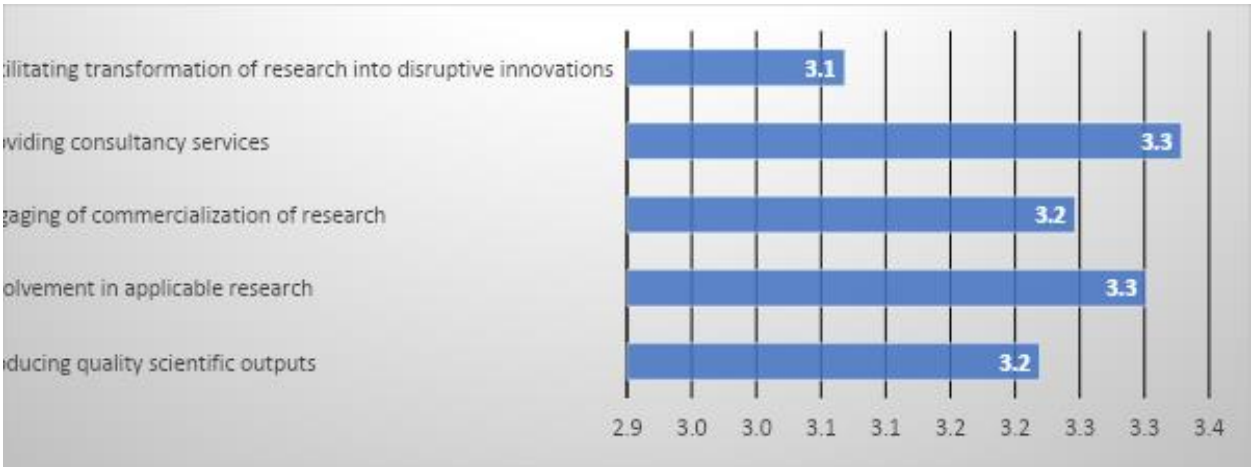

Figure 7 Academic research and researchers that can be utilised in your work

The respondents assessed the Academic research and researchers that can be utilised in their work on a scale from 1 (very unsatisfied) to 5 (very satisfied).

The mean scores did not diverge by a lot per category, with Consultancy services and Involvement in applicable research rated the highest (mean of 3.3), closely followed by Engaging commercialization of research and Producing quality scientific outputs (mean of 3.2). The last option, Facilitating transformation of research into disruptive innovations, had an average response value of 3.1.

8. How would you appraise the Universities' readiness to support innovation and start-ups/scale-ups in deep-tech areas:

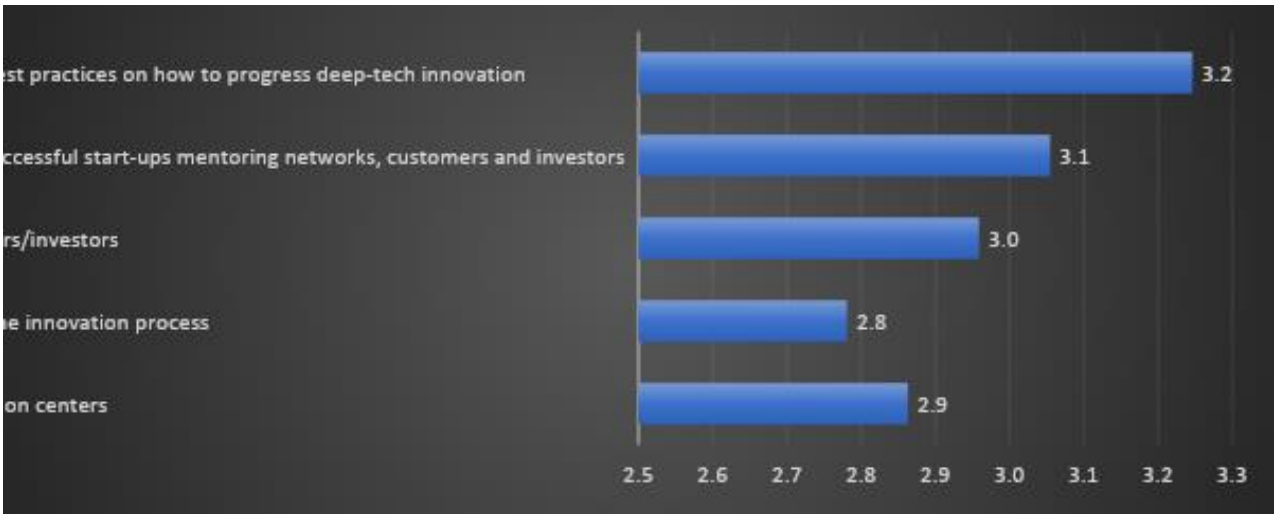

Figure 8 Universities' readiness to support innovation and start-ups/scale-ups in deep-tech areas

The participants assessed the Universities' readiness to support innovation and start-ups/scale-ups in deep-tech areas on a scale from 1 (very unsatisfied) to 5 (very satisfied).

The Support cooperation and exchange of best practices on how to progress deep-tech innovation is evident in the responses given the mean score of 3.2. Providing access to the ecosystem of successful start-ups mentoring networks, customers and investors received an average rating of 3.1. Universities were assessed as less ready to provide support in Engaging with potential customers/investors, Campus-based incubations centres, and Technology transfer offices (means of 3.0, 2.9 and 2.8).

9. How would you assess the current level of collaboration between organisations that support deep tech and Universities:

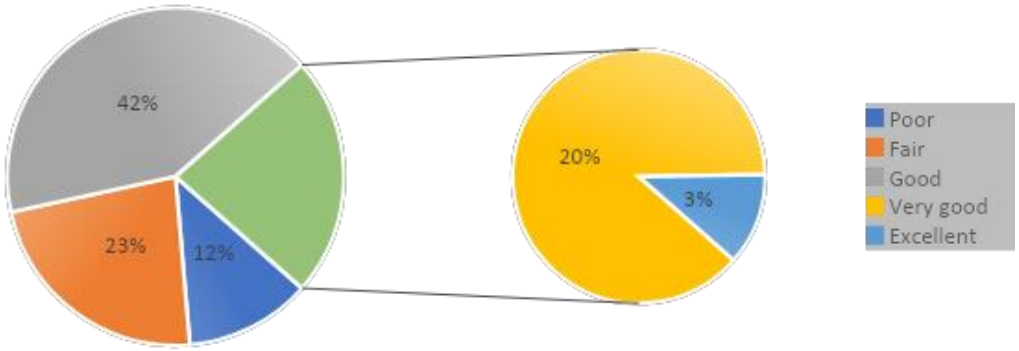

Figure 9 Current level of collaboration between organisations that support deep tech and Universities

The respondents assessed the current level of collaboration between organisations that support deep tech and Universities on a scale ranging from 1 (low collaboration level) to 5 (very high collaboration).

This question pinpointed a persisting weakness which the ABCD consortium seeks to address. Namely, 35 percent of the participants opted for the lower end of the spectrum, indicating a poor to fair level of collaboration. 42 percent stated that the appliance is satisfactory, leaving 23 percent in the higher range (very good to excellent).

10. What form of collaboration activities have you ever been engaged with universities?

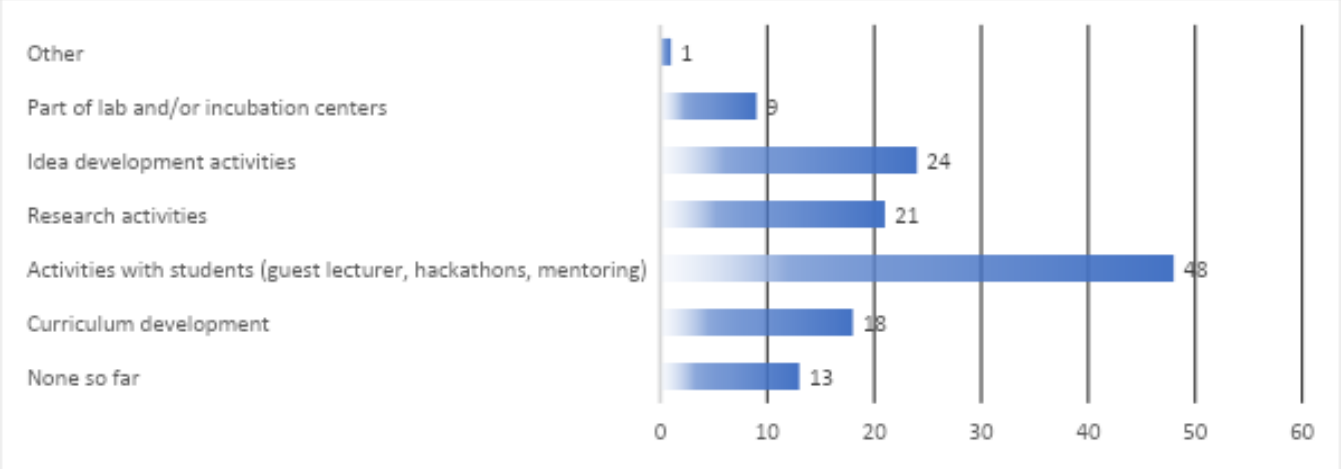

Figure 10 Collaboration activities with universities

The respondents could select multiple answers should their organisation be involved in more than one collaboration activity with academic institutions. The options ranged from None so far; to Curriculum development; Activities with students (guest lecturer, hackathons, mentoring); Research activities; Idea development activities; and Part of lab and/or incubation centres. At the end of the question, the respondents were given the option to add additional areas if not specified in the list.

Activities with students (guest lecturer, hackathons, mentoring) dominated the selection with 35.8 percent, followed by Idea development (17.9 percent) and Research activities (15.7 percent). External organisations still lack sufficient involvement in Curriculum development (13.4 percent), as well as lab and incubation centres (6.7 percent). One organisation specified coop with academia on Joint design and implementation of R&I and placement of the support measures.

Nonetheless, 9.7 percent ring the alarm in this respect as they lack any form of cooperation with higher education institutions, a disconnection that can harm the contribution universities seek to provide to practitioners and to the overall deep-tech ecosystem.

11. Would you be willing to become a member of The Alliance of Boundary Crossing for Deep Tech project (The consortium concentrates on integrative research and development of collaborative strategy between universities and deep tech organisations)?

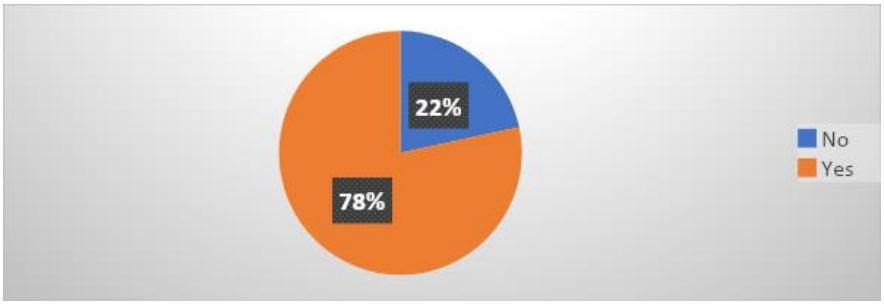

Figure 11 Willingness to become a member of The ABCD project

As indicated by the graphic depiction, the majority of the survey participants (78 percent) express high willingness to become members of The Alliance of Boundary Crossing for Deep Tech project and to concentrate on integrative research and development of collaborative strategy between universities and deep tech organisations. The response is highly encouraging as it provides grounds for bridging the gap detected in the answers to the previous enquiry where we detected a lack of any form of cooperation with higher education institutions.

12. What can you engage in as part of the collaboration:

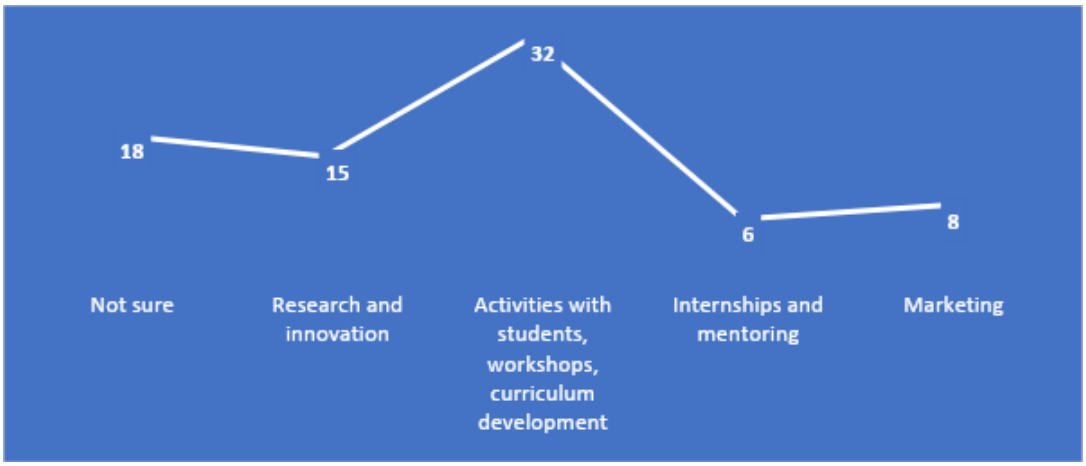

Figure 12 What can you engage in as part of the collaboration?

This question provided the option for open answers to be filled in accordance with the opinion of the study participants.

Most of the mutual engagement proposals centred around Sharing experience and Knowledge transfer (32 answers), with collaboration directed towards Contribution to educational programmes related to Deep technologies; Guest lectures on a particular competence; Staging start-up "week-ends"; Practitioners training students on soft and project management skills.

15 respondents indicated a willingness to engage in the ABCD project through Research and innovation, offering to provide their resources and infrastructure as part of collaboration; Developing deep tech products and services for the market together with researchers from the University; or even Funding particular projects of interest.

8 responses focused on ABCD engagement through Marketing and commercialization of research, while 6 offered to provide internships and tech mentoring for students.

Lastly, 18 respondents stated that they have a lack of experience in this regard and fail to see how they can engage in the ABCD project. Moreover, some of them indicated having a negative past collaboration experience in organising events like meetups and worships due to excessive bureaucracy on the part of HEIs or even lack of responsiveness.

13. What can Universities do to promote and enhance the collaboration with deep tech organisations:

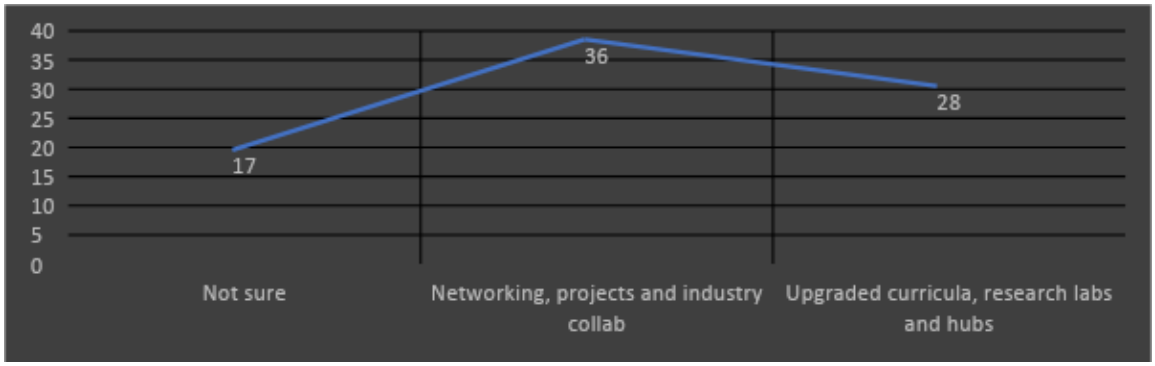

Figure 13 How can universities enhance the collaboration with deep tech organisations

This question was structured as an open-ended question taking the form of a statement which requires a longer answer to avoid limiting the answers or ideas of the survey participants.

According to the feedback obtained, 17 respondents (or 21.0 percent) state that they are not sure, that universities are not doing much in this regard, or are not ready to accept change.

The majority (44.4 percent) stated that universities can promote and enhance the collaboration with deep tech organisations by means of Networking, projects and teamwork with industry practitioners. This respondent group assesses Practice initiatives and links with the private sector as crucial for the ecosystem development. Organise stands, round tables with representatives of deep-tech companies, including experts from companies in teaching classes

Yet again, 28 responses (or 34.6 percent) call for Upgraded curricula, research labs and hubs. The proposals centre around Improving curriculums and bringing relevant lectures and speakers, as well as joint projects with relevant EU institutions and stakeholders; Introducing more practical work for students by arranging visits to start-ups, collaboration sessions, as well as proactive curricula after consultation with companies and using company data; Including deep tech knowledge and soft skills within academic curricula, Increasing excellence in teaching by including lectures from the industry and not just theoretical background, Organizing regular roundtables and conferences involving the industry professionals, Creating and supporting incubation, TTO and joint research centres; Encouraging multi-disciplinary research and collaboration in different fields of study via a systematic approach and open-access philosophy (stepping away from the current 'privileged' approach so that anyone who can contribute should be able to access databases and lab/hub infrastructure).

4. Concluding remarks

WP4 established the necessity to map the current stage of deep-tech start-ups and ecosystem in the home country (including the businesses and prototyping services and infrastructures). The mapping of key issues, motives and challenges took place by conducting an online survey with key deep-tech business representatives, NGOs and public bodies headquartered in the Western Balkan region. The survey was distributed online during the months of October and November 2023 by the 6 partner universities from the ABCD consortium: University American College Skopje, University of Montenegro, University of Sarajevo, Belgrade Metropolitan University, Budapest Metropolitan University and the Polytechnic University of Tirana.

The key objective of the field survey of the ABCD consortium is to map the current situation related to deep-tech ecosystems by reviewing the contribution of universities to deep-tech start-ups through four dimensions: (i) people, (ii) science & technology, (iii) university systems and (iv) ecosystems. The survey was answered by 74 organisations from North Macedonia, Montenegro, Bosnia and Herzegovina, Serbia, Hungary and Albania.

The respondents appraised the pool of talents that can be recruited from universities highly in terms of digital skills, relevant subject area knowledge and work motivation. In addition, they ascertain that academic research and researchers that can be utilised in their work when it comes to applicable research and consultancy services. The results indicate that universities are keen on supporting innovation and start-ups/scale-ups in deep-tech through cooperation and exchange of best practices on how to progress deep-tech innovation as well as by providing access to the ecosystem of successful start-ups mentoring networks, customers and investors.

Nonetheless, HEIs lag on Technology transfer offices to support the innovation process, and generally lack Facilitating transformation of research into disruptive innovations, which diminishes Students' ability to work in a complex business environment. *As a result,* ***77 percent feel that the Current level of collaboration between organisations that support deep tech and Universities can be enhanced.***

Although most participants already undertake Activities with students (guest lecturer, hackathons, mentoring) and Idea development, ***close to 80 percent expressed eagerness to become a member of the Alliance of Boundary Crossing for Deep Tech project.***

In this regard, the proposed areas for their own engagement encompass Applied Research Collaboration, Mentorship, Workshops, Networking (by using the connections to reach potential international collaborators of deep tech ecosystem), Policy and Strategy Development on fostering The Quadruple Helix Model of Innovation Dynamics that unites government, academia, community and industry.

The results indicate that Promoting and enhancing collaboration between universities and deep tech organisations can be mutually beneficial, fostering innovation, research, and talent development. Therefore, it comes as no surprise that the respondents pinpoint the need for UBC in the domain of

Education, Research, Commercialisation and Combined governance. The proposed strategies that universities can employ to promote and enhance collaborations encompass: Clear Channels of

Communication; Dedicated offices or liaison positions within the university to facilitate communication and collaboration with deep tech organisations; Regular contact with industry representatives, attending relevant conferences, and networking events; Collaborative R&D Centres for joint research and development that are co-funded and co-managed by universities and deep tech companies; Incentives such as grants, funding, or access to university resources; Interdisciplinary collaboration by encouraging researchers from different departments to work together on projects; Collaborative Workshops, seminars, and conferences that bring together academia and industry experts to discuss cutting-edge technologies and research trends; Inviting deep tech organisations to present their challenges and opportunities to university researchers and students; Internship Programs that allow students to gain practical experience at deep tech companies and can serve as a talent pipeline for these organisations; Course credits or academic recognition for internships to incentivize student participation; Sharing resources, including laboratories and equipment, to reduce the cost of research and development.