Enhancing Innovation in Higher Education Institutions: Barriers, Actions and Strategic Instruments for Sustainable Innovation

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Abstract: Innovation and sustainability have become increasingly important in recent years in education and research, helping to address global challenges and strengthening the collaboration between universities and industry. Integrating sustainable innovation practices in higher education institutions (HEI) plays a key role in creating a support system for academic and industrial collaboration and delivering value to society. Sustainable innovation involves making intentional changes to an HEI organization's philosophy and values, as well as to its products, processes, or practices. It serves the specific purpose of creating social and environmental value in addition to economic returns. Even so, there is still a need to improve the transfer of knowledge and technology as an integrated system between university and industry. The paper explores how universities develop an environment favourable for innovation while fostering a supportive culture for it. The article presents the findings from round table interviews involving forty participants with the following profiles: research managers, research advisors, innovation advisors, project managers, project support staff, researchers in education processes, support staff for researchers in project implementation, solution development, technology transfer offices, and other similar profiles. For the discussion three exploratory questions were given regarding the problems/barrier's universities face in sustainable innovation, actions that should be taken to increase innovation potential, and means/instruments of innovation in an academic environment. An extra question was presented looking for suggestions for possible actions and means as strategic steps for a brief period intervention of 6-12 months. This work sheds light on several critical aspects related to sustainable innovation in HEIs by investigating barriers hindering innovative thinking, exploring organizational and individual-level actions, and examining the means and instruments of innovation in an academic environment. The research data has offered valuable insights into effective strategies for overcoming barriers and creating an environment that fosters innovation. Furthermore, the study provides practical recommendations and short-term strategies for empowering universities to create a vibrant culture of innovation and maximize their impact on research, education, and knowledge transfer.

Keywords: Innovation, Universities, Impact, Strategies, Sustainability, Education

1. Introduction

Innovation, Sustainability, Digitalization and Entrepreneurship are emerging areas in universities (Kreiterling, 2023). The role of universities is crucial in fostering innovation as they are centres of knowledge creation and dissemination, and can, therefore, manage effective transfer and utilisation of knowledge and bring economic and societal impact (European Union, 2019). Consequently, universities explore more innovation and sustainability through their research, rethink the education system, and try different models of how to deliver and transfer innovation outcomes to real-world applications and make a positive impact (Kreiterling, 2023). Higher education institutions (HEIs) could integrate innovative thinking concepts and practices into various aspects of their operations. These encompass education and curricula, research endeavours, facility and campus operations, community engagement and awareness, organizational management and frameworks, as well as evaluation and reporting mechanisms. (Lozano, et al., 2015).

The Organisation for Economic Co-operation and Development (OECD, 2005) defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. The concept of the entrepreneurial university was developed by Etzkowitz and Leydesdorff (2000) and became one of the key concepts for the triple helix model where universities need to evaluate the traditional role of education and research and add a third mission that contributes to the economic growth and the transfer of research results from the lab to the society and economy. Innovation, from a university research point of view, and the way it is used in this study is defined as the process of translating knowledge and findings generated through academic research into new or improved products, services, processes, or systems that bring about positive societal, economic, or environmental impact. Innovation involves the application of creative thinking, experimentation, and collaboration to develop solutions that address pressing challenges, meet market needs, or create opportunities for societal advancement (Etzkowitz and Leydesdorff, 2000).

The fusion of education, research, innovation, sustainability, technology, business, and an entrepreneurial mindset is creating the playground for achieving competitive and sustainable developments in society.

Universities have to take on this new role of facilitators of innovative thinking by creating, developing, and applying new innovative environments (Morawska-Jancelewicz, 2022).

1.1 Research Questions

Overcoming some of the barriers requires HEIs to change their education and research mindset and establish a robust innovation strategy aligning with their overall objectives, set clear goals, and define a roadmap for execution.

The main goal of this article is to inspect how sustainable innovation is set in the holistic picture of universities. The following research questions (RQs) have been established for this paper.

RQ1 What problems/barriers do universities face in sustainable innovation?

RQ2 What are the actions that should be taken to increase the innovation potential in universities?

RQ3 What are the means/instruments of innovation in an academic environment?

The three Research Questions have been followed by an action question: Propose 3 actions and means as steps for the next 6-12 months.

1.2 Contextual Framework

Higher education institutions are facing many challenges in education, research, and innovation. The HEI is affected by the changes and innovations that take place in societies and economies globally. It is widely held that HEI should adhere to these changes and models, and innovate accordingly (Barber, et al., 2013). Under the new circumstances, HEIs should rethink their model of functioning; create knowledge that can be commercialised into new products and services; educate researchers and students in innovation and new ways to implement the science at the same time as acquiring funding for their research.

Research has already found certain barriers that HEIs are facing in enhancing their capacity for delivering innovation. In recent years, the universities expanded rapidly, and as seen by Hall and Lulich (2021), even though universities adopted innovation, entrepreneurship and transformation in their strategic plans, there are still some missing parts: plans do not express visions of bold initiatives, restructuring or 'bold innovation'; do not express the type of competitive drive; do not necessarily provide mechanisms to fulfil the goals; no facts about measured changes. It is common for HEIs to encounter difficulties when attempting to translate innovative ideas into practical, scalable solutions. Several barriers often impede the HEIs from thinking about innovation from research and development and implementation of innovation in future commercial solutions (Gkrimpizi, Peristeras and Magnisalis, 2023) and among these barriers are the lack of planning and focus, issues related to applicability and continuity of actions, and resistance to change.

Another dimension of introducing sustainable innovation in HEIs and education relates to the need to establish a collaborative work environment within HEIs. According to Margalef García and Pareja Roblin (2008), fostering such an environment presents a significant challenge. The authors emphasize the importance of facilitating collaboration among colleagues, staying open to new ideas, sharing power and supporting others by allocating time for teamwork and colleagues (Margalef García and Pareja Roblin, 2008). Furthermore, in a study on the successful adoption of a new blended learning approach, Garrison and Kanuka (2004) found that the creation of clear institutional policies for innovation, the establishment of supportive organisational structures at HEIs, such as contact points or specialised units, and a managerial strategic approach to innovation are essential.

Some authors suggest that in addition to the managerial support for innovation initiatives as a "top-down" approach, there must also be a buy-in from the academic staff for the strategic orientation towards innovation at HEIs. MacKeogh and Fox (2009) highlight those negative attitudes among academic staff towards innovations, low acceptance of new actions and education models, and lack of awareness about the potential and quality of these innovations emerged as barriers to the integration of innovation in universities.

Therefore, understanding and addressing these barriers is crucial for HEI to navigate the path towards innovation and unlock its true potential. The lack of planning and focus is a common barrier that HEIs face when attempting to drive innovation (OECD, 2016). Without a clear strategic roadmap and goals, it becomes challenging to align efforts and allocate resources effectively.

Efforts to enhance innovation potential within academic settings involve several drivers and actions. The facilitation of closer engagement with industry and businesses as part of everyday research activities fosters knowledge exchange, technology transfer, and collaborative research initiatives that align academic efforts with

real-world challenges and opportunities. Well-functioning links between universities and companies can stimulate economic growth (Mansfield, 1991; Salter and Martin, 2001) and help solve societal problems.

Brennan, et al. (2014) mention that integration of innovation in the university research context encompasses a wide range of activities including, but not limited to, technology transfer, commercialization of research outcomes, interdisciplinary collaborations, and the development of entrepreneurial mindsets among researchers and students. As such, innovation and the innovation capacity of a nation depend not only on the strength of individual players (firms, universities, government research laboratories, etc) but more importantly on the links between those actors (Morlacchi and Martin, 2009). These benefits may be delivered through the commercialisation of technologies resulting from academic research.

Schumpeter's definition of innovation is linked with the economic and growth aspect of innovation by defining it as the commercial or industrial application of something new, such as a new product, process, or method of production, but it may also manifest itself as new markets or sources of supply, as well as new forms of a commercial business or financial organisation (Schumpeter and Swedberg, 2021). Additionally, cultivating a new organizational culture, strategy, and priorities within universities is essential. Equally important is the development of knowledge in innovation and the building of competencies among researchers. Innovation is a new product, but it may also be: a new process of production; the substitution of a cheaper material, newly developed for a given task, in an essentially unaltered product (Kline and Rosenberg, 2010); the reorganization of production; internal functions, or distribution arrangements leading to increased efficiency; better support for a given product; lower costs or an improvement in instruments or methods of fulfilling innovation.

Furthermore, establishing a robust support system within universities is crucial. Such systems provide guidance, mentorship, and resources to facilitate the translation of research outcomes into practical applications. Innovation and sustainability have become increasingly important in recent years in education and research in addressing global challenges and strengthening the collaboration and transfer of knowledge between public education and private sectors (Kozirog, Lucaci and Berghmans, 2022).

Finally, ensuring access to resources, such as experts in intellectual property rights (IPR), innovation, and related fields, is vital for navigating legal and commercial aspects of innovation, protecting intellectual assets, and maximizing the impact of academic research. Technology Transfer Offices (TTOs) are pivotal in facilitating the transfer of research outcomes to commercial applications (Morawska-Jancelewicz, 2022), leveraging expertise in IPR and commercialization strategies (Weckowska, 2015). Additionally, adding new competencies and practices in innovation and sustainability could make a university stand out in its domains, attracting approaches to new research and actions (UNESCO ESD Monitoring and Evaluation, 2012) thus, by adopting a comprehensive and holistic approach, HEIs can make significant strides towards achieving the Sustainable Development Goals.

Considering the above-mentioned issues, HEI innovations have to be nurtured via changes in collaboration and managerial processes, sustainable ecosystem and industry collaboration, funding strategies and efficient allocation of resources, and new skills and competencies for students and the academic staff, to name a few. To unveil the barriers, actions, and drivers that will create more innovative universities, this study presents the research questions and the methodological background of our analysis, which is then followed by an in-depth description of the respective research results.

2. Method

We looked at the research styles that could be used to answer best our need to explore the barriers to innovation and the research questions, and we conducted a round table discussion to answer our research aims for this study. The choice of research style depends on the aim of the research, the research question, the degree of desired research autonomy, the level of investigator/interviewer intervention, the level of participants freedom to speak on a given question, the available resources, the time frame, and aesthetics (Crabtree and Miller, 1999; Brewer and Hunter, 1989). As shown in Figure 1 below (Brewer and Hunter, 1989 cited in Crabtree and Miller, 1999) the study is at the description stage and the qualitative research questions were used to describe better the status of the innovation in universities.

The purpose of the round table discussion is to provide a place for the exchange of ideas and discussion of their relevance in the way of generating innovation) in the field of research where this is applied (Crabtree and Miller, 1999) Round table discussions are part of the qualitative research and are small group discussions where everybody has an equal right to participate. A round table is not a public meeting - it is a focus event to closely explore specific issues identified elsewhere or to identify contemporary issues not addressed before, it can be used to explore solutions, define actions, and develop strategies. A round table confronts issues and ideas rather

than people and aims to create a win-win situation rather than a win-lose scenario (Day, 1998; Ashton, de Angelis and Graf, 2014). The premise on which the idea of round tables is based is simple – participants, be they researchers, administrators, experts, local authority employees, members of community-based organisations or members of the public, are seen as being of equal stature (Day, 1998).

Aim	*Analysis Objective*	*Research Question*	*Research Style*
Identification	Identify/name	What is this? Who is that? What is important here?	Field, doc-hist, philos
Description	Qualitative description	What is going on here? What is the nature of the phenomenon? What are the dimensions of the concept? What variations exist? What meanings/practices occur in lived experiences?	Field, doc-hist, philos
	Quantitative description	How many? How much? How often? What size? How is the phenomenon distributed over space?	Survey
	Normative description	What is the value of a phenomenon?	Field, doc-hist, survey, philos
Explanation			
Generation/ association	Interpretive, explanation, generation	What is happening here? What patterns exist? How do phenomena differ and relate to each other? How does it work? How did something occur/happen?	Field, doc-hist
	Statistical, explanation, generation	What are the measurable associations between phenomena? Does variable x relate to other variables? Why does it work? Why did something occur?	Doc-hist, survey
	Deductive, explanation	Given these premises, then _____?	Philos
Explanation			
Testing/ prediction	Causal confirmation	What will happen if __? If __ then __? Does one variable cause the other?	Exper
	Theory testing	Is the original theory correct? Does the original theory fit other circumstances? Are there additional categories or relationships?	Field, doc-hist, survey, exper
Intervention/ control	Prescription testing Evaluation	Is __ more effective than __? Does __ have greater efficacy than __? How can I make "x" happen? What difference does this program/intervention make?	Exper (RCT) Field, survey

NOTE: Doc-hist = documentary-historical; exper = experiment; philos = philosophical;
RCT = randomized control trial.

Brewer and Hunter, 1989 cited in Crabtree and Miller, 1999

Figure 1: Research Aims, Analysis Objectives, Research Questions and Appropriate Research Styles

Round table discussions are a qualitative research method characterized by their interactive and collaborative nature, facilitating in-depth exploration of complex topics through participant-driven dialogue. They offer a platform where diverse perspectives can converge, allowing participants to share insights, experiences, and opinions in a conversational format. This method promotes rich data collection by encouraging open discourse and enabling participants to build upon each other's contributions, thereby generating nuanced understandings of the research topic. Moreover, round table discussions can foster consensus building among participants, leading to the identification of common themes, priorities, and potential solutions to research questions or issues under investigation.

However, despite their benefits, round table discussions present challenges: there is a risk of certain participants dominating the conversation, potentially marginalizing quieter voices and limiting the diversity of perspectives represented in the data. Organizing and conducting round table discussions can be time-intensive and logistically demanding, involving coordination of schedules, management of participant dynamics, and facilitation of meaningful dialogue. The qualitative part of the description phase chosen for this study and for the research questions seeks to explore the meanings and perceptual experiences of the practices to capture the holistic vision and interdependent nature of the system. There was no 'leader' as such, but there would be a facilitator to ease the work process and to maintain focus and scribes to record the process, decisions, and actions.

To uncover the problems and challenges faced by HEIs in fostering innovation, we organised a series of round table discussions - as part of the problem description step of the research. The primary objective was to identify and understand the barriers that hinder innovation within the university setting and determine the necessary actions to overcome them.

Based on the Day (1998) and Crabtree and Miller (1999) studies, we designed the fifteen-minute discussion tables: within an hour time slot, a maximum of four round table presentations took place. In the general setup of the arrangement, the host was the presenter and introduced the theme for two minutes then switched to the moderation of the open discussion. The goal of the round table discussions was to find out from the participants

about the innovation barriers and actions they have noticed in their institution. To be a part of the study, the participants were informed that their answers would be anonymised, and professional notes would be taken.

The round table discussion ran in a small scenario: the participants had to imagine they were the appointed managers of the newly created "Innovation Driver Unit" in their organisation, for which they needed to develop and implement the unit strategy. To help in creating the strategy the RQ questions have been unveiled to the participants on a flip chart sheet as shown below.

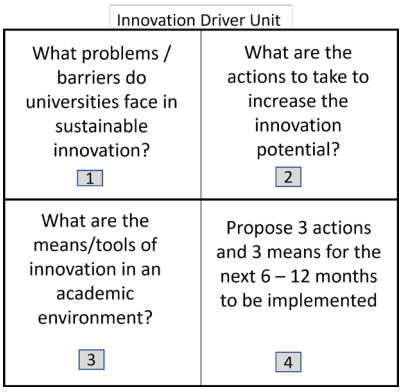

Figure 2: Material used for the round table discussions

The questions were asked one by one and approximately three minutes for discussion was given. Notes were taken on the flipchart while the discussion was taking place and confirmed with the participants that the notes were what they were expressing. The research conducted in this study involved only four groups of forty participants at the same conference, which may present a limitation in terms of the diversity of ideas collected. The restricted number of participants and their professional profiles may not fully capture the wide range of perspectives and experiences necessary to comprehensively understand the barriers and drivers of sustainable innovation in higher education institutions. To address this, the intention is to replicate the setup with an additional 2-3 events, incorporating participants from varied profiles and levels in HEIs management.

3. Result

The results of this paper have been collected while implementing four rounds of 15-minute round table discussions at the EARMA (European Association of Research Managers and Administrators) Conference 2023: Widening and Deepening of the RMA Profession, 24-26 April, Prague. The conference aims were to share best practices in research, innovation and education in HEI and network and it was attended by 1,400 participants from the Research Management and Administration community; 40 representatives from universities, applied sciences institutions, and research centres worldwide participated in the round table discussions. The profiles of the participants were: research managers, research advisors, research advisors or professional experts in pre-award and post-award phases of projects, innovation advisors, project managers, project support staff, researchers in education processes, support staff for researchers in project implementation, solution development and technology transfer office contacts, and other similar profiles. Discussions were organized in groups of ten, each comprising diverse professional backgrounds.

The answers from the flipchart have been inserted in a database coding the rounds, questions, and answers, and creating 5-6 labels for each question to classify the answers. The labels have been correlated with the Contextual Framework and the literature review.

3.1 Observations from the Round Table Discussions (Data Collection)

During the collection of data, four round table discussions were run, and the lead researcher of the table and presenter made sure not to allow one person/sector of the table to dominate the discussion and ensured that everyone got a chance to speak.

The observations gathered from conducting the round table interviews at the conference provided valuable insights into the dynamics and effectiveness of the discussions. Firstly, the attendance numbers did not vary significantly across (10 to 11 participants per table). Secondly, the participants at the tables had different professional backgrounds and were from different organisations, creating a balance and adequate representation in the group. Thirdly, the clarity of the process varied: some participants found the guidelines straightforward, while others required additional explanations regarding the research questions (RQs) being

addressed. During the discussion, no person was appointed to answer, but if there were no answers, then the lead researcher asked about the type of organisations they were from and if there was something that they could tell about their organisations. It made people comfortable to talk about the areas that they knew and quickly they were happy to talk about the other areas and aspects of innovation that were on the flipchart sheet. The allocated time of 15 minutes per discussion group was thought sufficient for the exchange of ideas, yet some persons or groups desired more time to dive deeper into their specific barriers or actions.

There was a noticeable trend towards thematic discussions aimed at harmonizing perspectives and responses among participants. Interestingly, differences emerged between attendees from higher education institutions (HEIs) and applied sciences university's regarding their opinions and experiences. While some topics prompted consensus, particularly among HEI representatives, discussions with applied sciences participants often brought forward distinct viewpoints, reflecting their unique operational contexts and objectives such as close collaboration with industry or product-based research.

When the four questions were answered, a short oral summary was given and then there was an exchange of business cards or email addresses for further contact if interested. The tables ran one after the other for one hour, changing groups every fifteen minutes.

Overall, these observations emphasize the importance of facilitating robust thematic discussions to enhance the effectiveness and inclusivity of future round table interviews.

3.2 Results from the Round Table Discussion

The general results obtained after the execution of the round table are shown below, answering each of the established research questions (RQ). The focus here is on the objective reporting of the participants' answers, leaving the interpretation and implications for the discussion section.

3.2.1 Problems/barriers that universities face in sustainable innovation

The motivation behind the RQ1 'What problems/barriers do universities face in sustainable innovation' lies in the desire to understand and address the barriers and challenges that research and education organizations encounter in their transition towards a culture of innovation. By identifying these barriers, the study aims to shed light on the specific needs of universities as they strive to embrace innovative thinking. The results (represented in Figure 3) present the recorded responses and corresponding numbers that highlight specific barriers faced by universities in sustainable innovation according to the participants.

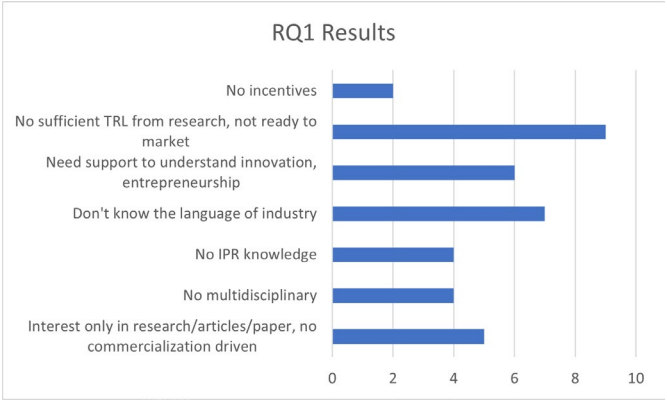

Figure 3: RQ1 answers from participants

Nine participants noted a lack of a sufficient Technology Readiness Level (TRL) in research, suggesting that the outcomes are not yet ready for market commercialization and a clear link with the lack of knowledge on IPR (4 answers). Seven participants expressed a lack of familiarity with the language and dynamics of the industry. Six participants highlighted the need for support in understanding innovation and entrepreneurship and other skills to build the innovation thinking approach, to move away from the interest in only scientific research articles. Lastly, two participants indicated a lack of incentives for innovation within the university environment.

3.2.2 Actions that should be taken to increase the innovation potential in universities

The RQ2 – 'What are the actions to take to increase the innovation potential in universities?' motivation lies in the appeal to identify specific actions that can be implemented at both the organizational and employee levels

to foster and enhance innovation within universities. The results (represented in Figure 4) present the recorded responses and corresponding numbers that highlight various strategies and actions needed to promote engagement with businesses and foster innovation within universities.

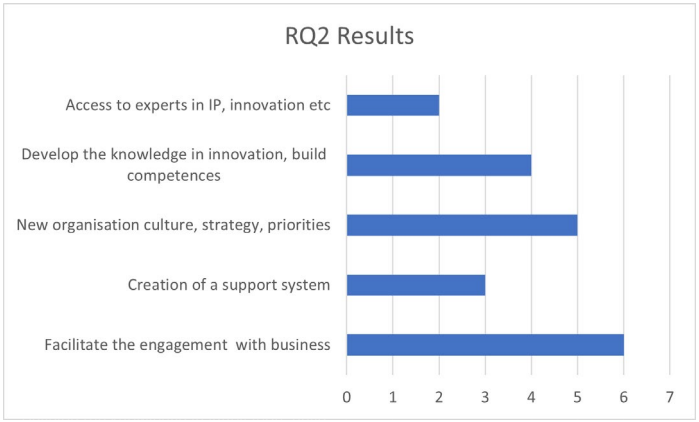

Figure 4: RQ2 answers from participants

Six participants emphasized the importance of facilitating engagement with industry and businesses in day-to-day research. Five respondents highlighted the importance of cultivating a new organizational culture, strategy, and priorities. Four respondents stressed the need to develop knowledge in innovation and build competencies. Other answers emphasized the creation of a support system, and the need to access resources such as experts in intellectual property (IP), innovation, and related fields.

3.2.3 Measures/instruments of innovation in an academic environment

The motivation behind RQ3 'What are the means/instruments of innovation in an academic environment?' intends to identify and understand the various drivers, tools and instruments that can be employed to foster innovation within an academic setting according to the participants at the round table discussions. The results (represented in Figure 5) present the recorded responses and corresponding numbers that highlight the means and instruments of innovation within an academic environment.

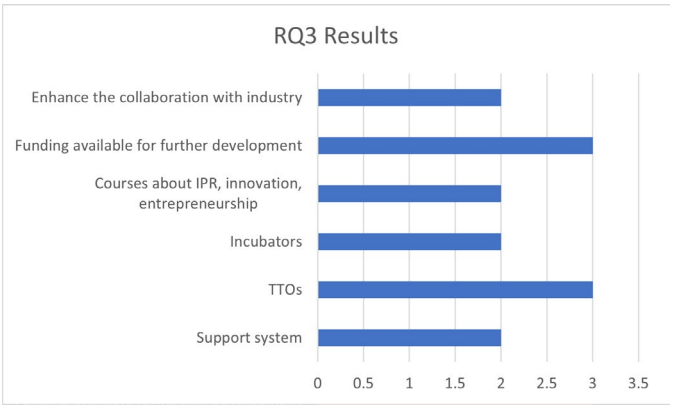

Figure 5: RQ3 answers from participants

Three participants mentioned the significance of Technology Transfer Offices (TTOs) and the other three respondents emphasized the lack of availability of funding for further development. Two participants emphasized the importance of a support system. Two participants highlighted the role of incubators in fostering innovation and others highlighted the need to enhance collaboration with industry. Similarly, two participants mentioned the importance of offering courses and programs focused on Intellectual Property Rights (IPR), innovation, and entrepreneurship.

3.2.4 Actions and measures as strategy steps for the next 6 – 12 months

The Q4 is a question addressed to the participants to propose actionable solutions for overcoming the barriers and challenges identified. The motivation for using this Q4 lies in the desire to identify and recommend specific actions and tools that can be implemented in the short-term to medium strategy to facilitate the transition of

universities towards a sustainable innovation approach. Recognizing the urgency and need for immediate progress, this study aims to explore and highlight the initial steps that universities can take within a defined timeline to foster sustainable innovation.

Our results (represented in Figure 6) present the recorded responses and corresponding numbers that highlight recommended actions and means to foster sustainable innovation within universities and answers given by the participants at the round table.

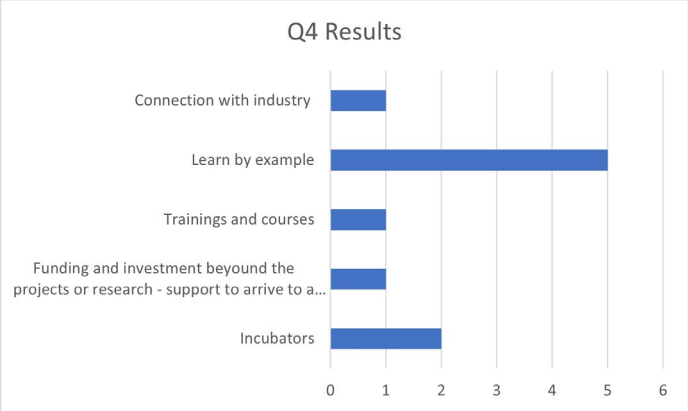

Figure 6: Action Question 4 Answers from participants

Five participants emphasized the importance of learning by example by creating ambassadors from the researchers who followed the innovation path. Two participants emphasized the importance of incubators for nurturing collaboration with industry and creating innovative ventures and startups emerging from academic research. Other participants stressed the value of training and new skills, stronger TTO offices with experts in the field of innovation and commercialization.

4. Discussion and Conclusion

The paper discusses the barriers, drivers, and supportive actions that HEI could implement in their strategies and activities for implementing sustainable innovation in their research and education for their students and academic staff. The findings in this study underscore the importance of various means and instruments in fostering innovation within HEI. The four research questions were posed to the participants with the specific motivation to determine the barriers that research and education organisations are facing; determine the needs that they have in switching to innovation thinking, the actions that they need to take and the tools that should be used to reach better outcomes. The sub-sections are following the structure of the Research Questions.

4.1 Problems/Barriers That Universities Face in Sustainable Innovation

Through the investigation of barriers hindering the implementation of sustainable innovation in HEI, we have identified key insights that can inform strategic interventions and foster innovative thinking within the institutions. From the theoretical part, the findings show the gaps in planning, applicability, and resistance (Gkrimpizi, Peristeras and Magnisalis, 2023). Similarly, the academic stakeholders emphasize they lack time, consistent funding and strategies for innovation (Hall and Lulich, 2021) and the universities are not oriented to the commercialization of knowledge (Barber, et al., 2013). Even more, they lack the language of industry and innovation literacy and dynamics of the industry (MacKeogh and Fox, 2009). Equally, many participants noted unfamiliarity with industry language and dynamics, as well as the prevalence of low TRL levels where research often stagnates due to inconsistent funding and strategies. Moreover, they emphasise that the academic focus and evaluation as of now is on research and publications and not driven by commercialization. The findings of the barriers and problems HEIs face in introducing sustainable innovation thinking underline the multifaceted nature of barriers hindering its implementation.

4.2 Actions That Should be Taken to Increase the Innovation Potential in Universities

The study's exploration of actions to increase innovation potential, such as fostering engagement with industry and cultivating a new organizational culture, contributes to the academic discourse on the triple helix model of university-industry-government relations (Etzkowitz and Leydesdorff, 2000). Furthermore, it is essential to equip students and researchers with skills and resources in innovation, entrepreneurship, IPR, and multidisciplinary approaches, while fostering a culture that recognizes and rewards innovation as a research outcome. Where

now in most universities only scientific papers are formally recognised as research outcomes leading to an absence of incentives for researchers to integrate sustainable innovation in their fields. The participants' emphasis on engagement with the business sector, interdisciplinary collaboration, and the development of entrepreneurial mindsets among researchers and students aligns with the growing body of studies and authors advocating for a holistic approach to innovation in academia (Correia, et al., 2024).

4.3 Measures/Instruments of Innovation in an Academic Environment

The study shows that, in addition to the need for stronger TTO offices, access to adequate funding is crucial for supporting the progression of innovative ideas from concept to commercialization as many of them tend to have a lower TRL and that is making the commercialization path harder. While some organisations recognise the support of the TTOs as drivers for innovation others are still lacking the systems or the instruments used are too weak. The TTO support system (Weckowska, 2015; Morawska-Jancelewicz, 2022) should ensure access to experts in IP, innovation, business, commercialization, and related fields. Other measures that have been highly recommended by the participants are training, courses and programs focused on IPR, innovation, and entrepreneurship to equip researchers and students with the necessary knowledge and skills to navigate the innovation landscape effectively. From the theory and interviews, we can see that collaboration with industry stakeholders is important for fostering the development of innovation hubs, (Siebert, Wasserman and Fisher, 2019) knowledge exchange and joint research initiatives. Those collaborations are enhancing universities' innovation capabilities and ensuring the relevance of their research. Furthermore, a supportive system in the HEIs, including incubators, provides resources and mentorship to accelerate entrepreneurial ventures stemming from academic research and has been highlighted as important by the participants, which aligns with the studies and research looking at academia as an entrepreneurial ecosystem and support systems for innovations. (Correia, et al., 2024). Additionally, by exploring the means and instruments of innovation in an academic environment we show valuable insights on effective strategies to be implemented for overcoming barriers and creating an environment that stimulates innovation.

4.4 Actions and Measures as Strategy Steps for the Next 6 – 12 Months

The practical recommendations provided in this study offer valuable insights for university strategic managers, administrators, and policymakers aiming to foster a vibrant culture of innovation. The proposed actions and short-term strategies, acting like drivers that the study identified in the discussion with the participants are providing actionable recommendations to accelerate the transformation of universities' innovation culture and practices such as:

- To create Ambassadors for Innovation: identify researchers who have successfully navigated the innovation path and can serve as a model for others; promote their success stories.
- To establish Incubators to nurture collaboration with industry and to incentivize and support innovative activities such as startups emerging from academic research.
- To develop training and courses for researchers and students with target programs in the development of competencies in innovation, entrepreneurship, and IPR.
- To improve access to additional funding through better industry collaboration and investment to support the development and commercialization of research with a lower TRL.
- To strengthen the TTO and the support system to provide guidance and resources for researchers and innovators.
- To cultivate a new organisational culture by developing strategies that prioritize innovation within the HEIs and support risk-taking and creativity among researchers and students.

Overall, this study shows that there is not just one way to bring more innovation and commercialization of research created on the HEI, but it is a mix of actions and tools that universities have to take to cultivate a culture of sustainable innovation, drive impactful research outcomes, and contribute to solving societal challenges while advancing economic development. As for future work, there are several avenues for further exploration. Further research in the field could continue the study and conduct use-case studies to examine real-life examples of universities successfully implementing sustainable innovation practices, thus providing valuable insights into effective strategies and their outcomes. Additionally, investigating the role of policy frameworks and government support in facilitating sustainable innovation in universities would contribute to understanding the broader institutional context.

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