EUTOPIA REVIEW

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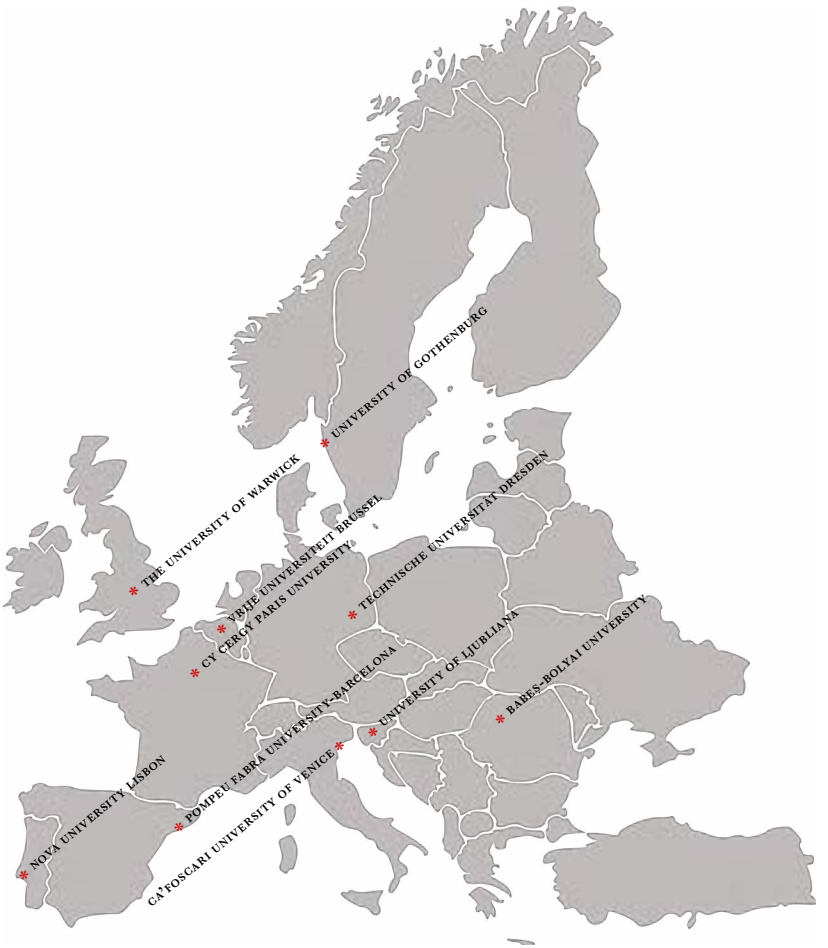
CREATING AN ENTREPRENEURIAL MINDSET

SCIENCE DIPLOMACY



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Alliance of 10 European universities

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Established in 2019, EUTOPIA is an Alliance of ten European universities committed to developing, through transnational cooperation, a new model for European integrated higher education institutions as defined by the European Universities Initiative.

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The EUTOPIA Alliance brings together the operations of

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Universitatea Babeș-Bolyai in Cluj-Napoca (Romania)
Vrije Universiteit Brussel (Belgium)
Università Ca' Foscari Venezia (Italy)
CY Cergy Paris Université (France)
Technische Universität Dresden (Germany)
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Universidade Nova de Lisboa (Portugal)
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eutopia REVIEW

The *EUTOPIA Review* provides a space for discussion while facilitating collaborative and cross-disciplinary approaches, that you can follow on our website:

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EUTOPIA REVIEW

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Creating an Entrepreneurial Mindset

2024

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Fostering a Culture of Entrepreneurship within the EUTOPIA Alliance

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ABSTRACT: EUTOPIA'S CONTEXT

EUTOPIA is evolving towards a confederated model, functioning as an overarching entity that informs and advises partner institutions without binding authority. The recommendations in this White Paper aim to assist EUTOPIA in enhancing collaboration around entrepreneurship within this flexible and non-binding framework.

This White Paper provides recommendations on entrepreneurship for the EUTOPIA alliance, incorporating input from the Connected Community on Entrepreneurship and Innovation consisting of four partner universities (UPF, VUB, NOVA, UNIVE) that have shared their expertise to guide how EUTOPIA can strengthen collaboration in this area. The paper serves as a strategic advisory document for EUTOPIA, which can integrate these recommendations into its current structure and then advise all alliance members. In this way, the alliance members can improve future collaboration around entrepreneurship.

The EUTOPIA Alliance, a confederation of ten European universities, is committed to fostering a culture of entrepreneurship that can

drive innovation and economic growth by and through its member institutions. This white paper presents strategic recommendations aimed at enhancing collaboration and developing cohesive frameworks to support entrepreneurial initiatives in the EUTOPIA ecosystem.

Recognising the vital role that higher education institutions play in nurturing innovators, the paper highlights both current achievements and existing barriers within the alliance's entrepreneurial landscape. Key challenges include varying levels of institutional support for entrepreneurship, limited interactions between academia and industry, and fragmented access to funding resources.

The paper proposes nine actionable recommendations to address these challenges, as shown in the figure p 27, including establishing cross-institutional mentorship programs, promoting interdisciplinary innovation labs, standardising entrepreneurial curricula, and creating a shared innovation fund. Additionally, it emphasises the importance of engaging faculty, industry partners, and investors to build a vibrant entrepreneurial ecosystem.

The white paper concludes with a call to action, outlining essential next steps that include disseminating the recommendations among all ten universities, fostering participation in the Connected Community on Entrepreneurship and Innovation, and engaging university leadership to mobilise resources for implementation. By three collaborating and leveraging shared strengths, the EUTOPIA Alliance can cultivate an entrepreneurial culture that not only enhances academic excellence but also significantly contributes to societal advancement and economic resilience in Europe.

DISCLAIMER

The views and thoughts presented in this white paper reflect the perspectives of the authors in their capacities as professors, researchers, managers, and staff from their respective institutions. This paper does not imply any executive responsibility or binding authority within the universities of the EUTOPIA Alliance, and the implementation of these recommendations is, of course, subject to institutional approval and collaboration.

Introduction

Entrepreneurship and innovation entered the international debate on higher education in the past 20 years. Their relevance in policy-making oriented at the development and strengthening of tertiary education and academic research went well beyond their assessment as legitimate and relevant subjects of study.

Entrepreneurship, for instance, went from being practically neglected as a subject until the last decade of the past century to becoming a pivotal subject both in business schools' and engineering schools' programmes, as well as being a topic in a variety of "unusual" majors and degree, such as in humanities (Mescon, Van Rest, 2021).

Innovation, on the other hand, has a long-established history as a subject in a variety of programmes, but similarly to entrepreneurship, it entered in various forms the curricula of a variety of students in many different fields and specialisations.

One might say that, teaching-wise, entrepreneurship and innovation spilt over from the fields of economics, management and engineering and became a relevant topic across the board in higher education to equip human capital and young talents with skills, competencies and attitudes that enable them to act as agents of change in whatever career they will pursue and whatever endeavour– economic, social, cultural–they will embark on as citizens.

Entrepreneurship and innovation, though, became central in higher education institutions and created a strategic tension: the need to close the gap between basic research and its application has been a central theme in the evolution of universities. This tension generated a general movement of higher education institutions towards technology transfer and knowledge valorisation, a set of practices and organisational arrangements that went by different names in the past 30 years (e.g. technology transfer, triple or quadruple helix, entrepreneurial university). Based on

a sound and consolidated tradition in research (e.g. Acs et al., 2009; Audretsch, 2014), the consensus on making universities providers of "useful" knowledge grew to the point that national and international exercises in the evaluation of academic institutions inserted the "third mission" as a distinctive element. Universities.

The present white paper takes stock of the experiences and knowledge accumulated in years of academic research on innovation, entrepreneurship and higher education and on at least two decades of practical engagement, entrepreneurship and innovation by the universities represented in the connected community to propose an agenda for the Alliance. In particular, the white paper pictures the potential benefits coming from the consolidation of initiatives on innovation and entrepreneurship in the universities composing the Alliance, from the exchange of good practices and the federation of expertise and distinctive skills and contingencies. In particular, the white paper rests on the following assumptions:

a) All the universities in the EUTOPIA alliance have been active in engaging with their (regional) ecosystems to transfer valuable knowledge, co-create innovative knowledge, and valorise it in a variety of forms. Belonging to the Alliance, each university might share its own good practices and lessons learned from others' thus creating a European space within which capacity is built and disseminated.
b) Each university faces specific challenges and contingencies in terms of the sectors it dialogues with; the fact that universities are embedded in different economic fabrics in different European regions favours the emergence of distinctive capabilities and specialisations that might benefit all other universities in the network. In particular, we see the Alliance as a confederation of local hubs of innovation and entrepreneurship that serve their local constituencies and that act as anchors or conduits

for the distinctive knowledge and abilities developed elsewhere. In the long run, the Alliance might become a European space where knowledge on entrepreneurship and innovation created in a region by a university flows in the network and is efficiently anchored to other territories by allied universities that, in turn, share their distinctive knowledge and competencies. We see such a scenario as a way to create an effective and vibrant European entrepreneurship and innovation ecosystem.

1. Current Landscape: overview and analysis of existing support environment for entrepreneurship

The Pompeu Fabra University-Barcelona (UPF) has demonstrated a continuous commitment to fostering innovation and entrepreneurship. This commitment is evidenced by its numerous spin-offs, successful participation in European research projects, and targeted initiatives such as the INNOvalora program, which supports researchers with prototyping, market research, and IP strategy to bridge the gap between university research and private sector involvement. The university also operates a co-creation workshop called HackLab, providing students access to co-working spaces, technical equipment, and other materials to aid collaboration. The Flama Startup acceleration program supports bachelor's students in creating interdisciplinary final projects that connect with the business world.

UPF is strategically organised around a comprehensive set of applied research activities primarily concentrated in three key areas: health and life sciences, information and communication technologies, and social sciences and humanities. This diverse portfolio of research and development assets serves as vital fuel for accelerating entrepreneurial initiatives and fostering innovation.

Ca' Foscari University of Venice (UNIVE) promotes innovation and entrepreneurship through its dedicated

unit, PInk — Promoting Innovation and Knowledge. PInk bridges the gap between university research and the production system by fostering mutual innovation and development and supporting the exploitation of research results. The university offers a range of services to support companies, including technology transfer, consultancy, and networking, as well as specific initiatives such as access to university scientific instruments, patenting and licensing support, spin-off development assistance, and matchmaking events to facilitate collaboration between researchers and businesses. Research at Ca' Foscari focuses on a variety of topics: from the digital transformation of organisations to circular economy, from new materials and nanotechnologies to the interaction of cultures in a globalised world, from the sustainable transitions of regional and national economies to the development of tourism and cultural industries. There are six main thematic interdisciplinary attractors around which research is organised: complexity sciences, digital and cultural heritage, social innovation, international studies, green and blue growth, and innovation management.

The Vrije Universiteit Brussel (VUB) has established itself as a leading innovator with a strong track record in technology transfer. This is reflected in its high ranking in international innovation indices, its diverse range of research groups, and its focus on creating spin-offs and leveraging partnerships with industry. VUB's TechTransfer acts as the central point for innovation and technology transfer activities, offering services including legal advice, EU support, fundraising, and industry-university networking. VUB's research efforts are further supported by the Groups of Excellence in Applied Research (GEARS), which are research groups focused on specific themes supported by the Industrial Research Fund (IOF), which incentivises research with high valorisation potential. The Green Energy Park and ICAB provide space and support for early-stage enterprises focused on high-tech products

or services. The university also boasts numerous initiatives that support the entrepreneurial ecosystem, such as Fablab Brussels and StartLab.Brussels—the university's pre-incubator program—and FARI's Accelerator Program for AI Start-ups. These initiatives are backed by VUB faculty in the domain of E&I, in particular by members of the Brussels Entrepreneurship and Innovation Lab (BREL), which conducts high-level research and bachelor and master education in the domain.

NOVA University Lisbon (NOVA) actively promotes innovation and entrepreneurship by focusing on research commercialisation, support for student ventures, and collaborations with industry partners. The Technology Transfer Office (NOVA-TTO) identifies, protects, and transfers knowledge created in the university to businesses, supporting early-career researchers, doctoral students, and other university members. The university also operates the NOVA Incubator, which provides a space for spin-offs and start-ups with support services such as mentorship and funding, and the NOVA Entrepreneurship Centre, which offers programs and support for student entrepreneurship, fostering a culture of innovation within the university. The NOVA Open Labs, a series of themed innovation platforms that provide access to networks, equipment, and expertise, support companies in applying for research tax credits and other initiatives.

This analysis lays the groundwork for understanding the current state of entrepreneurship within the EUTOPIA Alliance. By identifying the strengths and weaknesses of each institution's existing structures, the white paper can then move towards formulating specific recommendations for enhancing technology transfer, promoting entrepreneurial activities, and creating a more collaborative and dynamic environment for entrepreneurship.

2. Barriers and Challenges

Although the EUTOPIA institutions act in their own environment, we identified barriers and challenges that hamper the development of an entrepreneurial culture across the universities. We grouped them at several levels: individual, institutional, ecosystem, international.

Individual

* Role identity of researchers: Taste for Science vs Taste for Commercialisation preferences with individuals and their leadership.
* Evaluation, promotion and career mechanics in academia.
* Resource and knowledge/capabilities constraints
* Time constraints.
* Fear of failure.

Institutional

* Subscallogy Transfer in broad institutions.
* Developing and harnessing an entrepreneurial culture
* Create room and institutional support for entrepreneurship in rules and regulations.
* Manage expectations on the role of a university in the ecosystem.
* Resource and knowledge/capability constraints.

Ecosystem

* Organising University-Industry Interactions in a structured and sustainable way.
* Balance the needs of the industry and investors with the education and research mission of the university.

International

* Complex national/regional regulations for the commercialisation of university research

* Splintered and regional-focused funding landscape for early-stage endeavours (sub-scale).
* IP-system

Over the past year, our efforts as Connected Community on Entrepreneurship & Innovation focused on investigating potential activities that could have been undertaken. Although the challenges listed above are broadly applicable and experienced by all partner institutions, we encountered significant obstacles that hindered establishing a unified framework for fostering a shared approach to entrepreneurship. The obstacles revolved around identifying a shared element that would not pose the risk of redundancy with other initiatives, as well as the difficulties of implementation stemming from organisational constraints within the respective universities. Also, considering the diverse areas of expertise among individuals and departments/offices within each university, our working group reached a consensus to promote initiatives that should not be pursued in isolation by individual partners but should be cultivated through collaborative efforts within the EUTOPIA network. Better coordination between EUTOPIA partners can address some of the most important barriers and challenges. Most notably, we will focus on the following interventions:

* Identify Tech Transfer Knowledge Experts across EUTOPIA and build a network.
* Build an EUTOPIA Accelerator Program for late-stage spin-off projects.
* Organise a bi-annual conference for entrepreneurial researchers of EUTOPIA to instil a sense of community.
* Gather data and document spin-off stories across the alliance to facilitate policy-making on the topic.

3. Opportunities for the Connected Community Collaboration

The initial actions outlined in this section highlight promising opportunities for collaboration within the Connected Community. Over the next two years, these initiatives will be developed and refined, laying a strong foundation for fostering entrepreneurship and innovation across the EUTOPIA Alliance.

3.1 Entrepreneurship in Social Sciences, Humanities and Arts

While entrepreneurship is often associated with technology and business fields, the humanities, including the arts, hold immense innovation potential, particularly in areas such as cultural industries, education, media, publishing, and social enterprises.

To promote entrepreneurship in the social sciences within EUTOPIA, the Alliance could consider several strategies that are both practical and effective and that are aimed at implementation in the coming years. Here are some proposals:

* *Interdisciplinary Incubation Programs*. Create incubation programs specifically focused on the social sciences, where students and researchers from these disciplines are paired with teams from other fields. This allows ideas and solutions from a social perspective to be more effectively transformed into entrepreneurial projects.
* *Develop Entrepreneurship Education in the Social Sciences.* Introduce a curriculum specifically targeting social sciences and entrepreneurship, with modules explaining how social and cultural innovations can lead to societal impact and commercial applications. This could be developed in collaboration with experts from Tech Transfer offices to bridge the gap between theory and practice.

* *Community of Practice for Social Sciences and Entrepreneurship.* Establish a platform within the Eutopia alliance where social science researchers and students can share experiences on entrepreneurship, discuss their ideas, and access mentors and investors. This could be a virtual community with regularly organised events, workshops, and networking opportunities.
* *Promote Cross-Sectoral Partner Projects.* Encourage collaborations between academic social science departments, the private sector, NGOs, and governments. Work with Tech Transfer offices to explore how entrepreneurship models from the hard sciences can be adapted for the social sciences, with tangible outputs such as social innovations or policy proposals with entrepreneurial potential.
* *Network with Civil Society Organizations and Policymakers.* Ensure that social science departments within the Alliance build strong networks with civil society organisations and policymakers. This can link entrepreneurship initiatives in the social sciences to real societal needs, enhancing their relevance and success.

3.2 Tech Transfer: entrepreneurship alignment and standardisation

In an increasingly globalised and competitive research environment, cross-border collaboration is essential. This is also one of the key objectives of the EUTOPIA Connected Community for Innovation and Entrepreneurship. However, international partnerships, particularly in Tech Transfer, require careful alignment of expectations and roles to succeed.

A recurring issue in such collaborations is that identical job titles or definitions, such as "business developer" or "project manager," are interpreted differently depending on the organisation or country. This leads to misunderstandings and inefficiencies, as expected tasks or outcomes may not align with reality.

To avoid these obstacles, it is crucial to move beyond job titles and begin by mapping out the processes and tasks within each Tech Transfer Office (TTO). We can create standardised definitions only with a shared understanding of responsibilities, ensuring smoother collaboration between international partners. This proposal aims to launch a study to identify key processes and tasks within Tech Transfer, forming the foundation for a harmonised set of definitions to facilitate successful international collaborations better. This exercise will also allow us to map specific expertise in each EUTOPIA TTO, further ensuring better collaboration.

To move forward with this proposal/project within Eutopia, we need the engagement of all Tech Transfer Directors and entrepreneurship managers in the EUTOPIA Alliance.

3.3 Entrepreneurial Finance and the investor ecosystem

The successful growth of entrepreneurship within the EUTOPIA Alliance hinges significantly on the financial resources available to support entrepreneurs and the mechanisms through which ideas are transformed into viable business ventures. It is crucial to enhance access to funding and refine the strategies that facilitate engagement with potential investors to develop a robust entrepreneurial ecosystem.

Many entrepreneurial initiatives within universities face financial constraints that limit their scalability. Early-stage ventures often struggle to secure the necessary capital for prototyping, market testing, and commercialisation. Additionally, the fragmented funding landscape across Europe can hinder effective resource allocation, making it challenging for entrepreneurs to identify and access appropriate funding opportunities. Furthermore, a lack of structured engagement with investors can result in missed opportunities for collaboration and support. Euto-

pia can act as a convening body to coordinate access to funding sources, facilitate introductions with investors, and support best practices sharing among alliance members.

* *Create a Unified Funding Platform.*
  Develop a centralised platform aggregating funding opportunities, including grants, venture capital, and angel investors for EUTOPIA members. This platform should list resources and provide matchmaking tools to align funding with project needs and facilitate joint applications for multi-institutional grants. Additionally, establish a network targeting seed funding for early-stage projects by partnering with public and private funding agencies to launch competitions and funding calls. This initiative will simplify access to capital and foster a collaborative, Europe-wide entrepreneurial ecosystem within the EUTOPIA Alliance by connecting entrepreneurs to cross-border funding and investor networks.

* *Leverage Partnerships with Investors.*
  Foster strategic partnerships with venture capital firms, angel investor networks, and corporate investors interested in supporting innovative projects emanating from academic research. Hosting pitch events and networking sessions at a European level can facilitate these connections, helping startups gain visibility and access to potential funding. Additionally, by showcasing a portfolio of entrepreneurial projects from diverse regions within the Alliance, Eutopia could attract international investors interested in cross-border opportunities, fostering a European-scale ecosystem of academic entrepreneurship.

* *Develop Collaborative Funding Models.*
  Encourage EUTOPIA members to explore joint investment funds or co-funding initiatives to support

high-potential ventures across the Alliance. By pooling resources and sharing risks, these collaborative models could provide stronger, more resilient funding for early-stage projects. This approach enhances EUTOPIA's capacity to act as an incubator or attract cross-border investors and reinforces its role as a hub for academic-driven innovation.

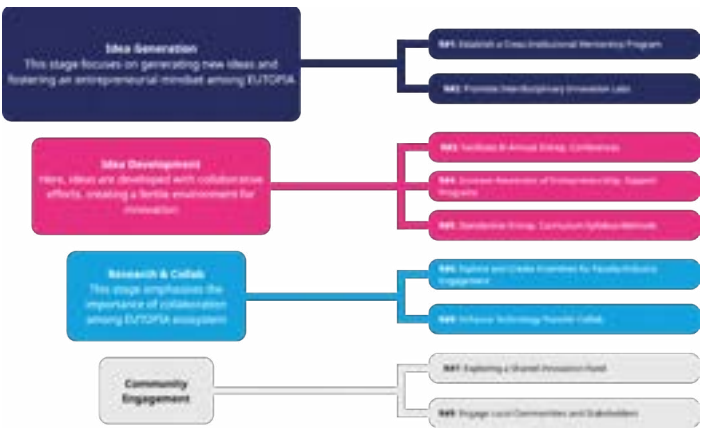
* *Engage Alumni and Industry Stakeholders.*
  Mobilise EUTOPIA alumni and industry partners to invest in promising ventures emerging from the Alliance. Creating specialised alumni networks focusing on entrepreneurship can foster a culture of giving back, where successful graduates can provide financial support and mentorship.

* *Enhance Financial Education and Support.*
  Provide training and resources for entrepreneurs on navigating the funding landscape, including grant writing workshops, investment readiness programs, and access to financial advisory services. Educating potential founders on best practices in securing funding will empower them to skillfully present their ventures to investors.

By addressing financial challenges and leveraging the collective resources of the EUTOPIA Alliance, we can create a unique startup ecosystem that sustains a diverse range of innovative ventures and positions higher education as a key driver in Europe's innovation landscape. This collaborative financial strategy will not only enhance/upscale the pipeline of entrepreneurial ideas but also attract a broader array of investors, ultimately driving economic growth. Through these targeted initiatives, EUTOPIA aligns with its broader mission to enhance collaboration and create lasting impact across the Alliance, reinforcing the essential role of higher education institutions in fostering innovation.

4.Recommendations for the EUTOPIA alliance

We present nine actionable recommendations designed to cultivate a culture of entrepreneurship across the entire EUTOPIA Alliance, extending beyond just the Connected Community. Initially, we highlight recommendations that are particularly feasible in the short term within the EUTOPIA MORE project timeframe (Dec.2022-Nov.2026), followed by those that require more time to take root and develop effectively.



The figure illustrates the structure of the recommendations, progressing from foundational idea generation to enhanced community engagement. Each level includes two to three specific recommendations, which are elaborated below.

Short-term recommendations

***R#1** Establish a Cross-Institutional Mentorship Program*

Create a network of mentors comprising successful entrepreneurs, industry experts, and alumni who can provide guidance and support to students and researchers across the

Alliance, preferably with an initial focus on social sciences, humanities and arts. This program should facilitate knowledge transfer and encourage entrepreneurial thinking all across the Alliance.

***R#2** Promote Interdisciplinary Innovation Labs*

Establish "alliance-wide" innovation labs that serve as collaborative spaces for students and researchers from all EUTOPIA member institutions. These labs will be launched during designated periods throughout the academic year, creating inter-university initiatives that federate each institution's unique capacities and competencies. By addressing specific challenges or problems identified at the alliance level, diverse teams can leverage their distinct strengths and perspectives to develop innovative solutions. Additionally, the innovation labs will facilitate local activities and moments of exchange, such as online workshops or intensive mobility weeks, allowing participants to share knowledge and collaborate effectively. This initiative aims to foster a thriving culture of entrepreneurship that not only enhances interdisciplinary cooperation within the Alliance but also empowers participants to tackle complex issues through a multifaceted approach, particularly in underrepresented fields such as the social sciences. The result will be a dynamic environment where innovative ideas can flourish and equitable access to resources and expertise is promoted across the Alliance.

Expected impact: Establishing alliance-wide innovation labs is expected to foster a greater number of startups and cultivate an entrepreneurial mindset within the social sciences, enhancing engagement with external partners. This initiative will increase patents and intellectual property assets while aligning with the ENTRECOMP Europe framework to develop essential entrepreneurial competencies among participants.

R#3 *Facilitate Bi-Annual Entrepreneurship Conferences*

Organise bi-annual entrepreneurship conferences within the EUTOPIA Alliance to create a dynamic platform for researchers, students, industry leaders, and policymakers. These conferences will be a forum to share best practices, highlight innovative initiatives, and showcase successful entrepreneurial ventures across the Alliance. By fostering networking opportunities and collaborative dialogue, participants can explore synergies, identify potential partnerships, and gain insights into emerging trends and challenges in the entrepreneurial landscape.

The conferences could also include workshops, panel discussions, and pitch sessions to ensure active engagement among attendees. By integrating this initiative into existing Erasmus+ programs, the event can leverage funding and resources to support transnational collaboration in higher education. Ultimately, these conferences will enhance the visibility of the EUTOPIA Alliance as a leader in entrepreneurship education and provide a significant impetus for developing a vibrant entrepreneurial ecosystem within the member institutions.

Expected Impact: The bi-annual entrepreneurship conferences are expected to significantly enhance collaboration within and beyond the EUTOPIA Alliance, leading to increased partnerships between academia and industry. By sharing best practices and fostering networking opportunities, these events will cultivate a stronger entrepreneurial culture, resulting in a higher number of innovative projects, enhanced visibility for participant initiatives, and a greater alignment with market needs and societal challenges.

R#4 *Increase Awareness of Entrepreneurship Support Programs*

Develop and implement comprehensive awareness campaigns highlighting the entrepreneurship resources and support services available at each EUTOPIA member institution. These campaigns should utilise various communication channels, including social media, newsletters, and

university websites, to ensure that the information reaches a broad audience of students, researchers, and faculty. The campaigns will encompass details about workshops, incubation programs, funding opportunities, mentorship initiatives, and access to innovation labs, all designed to nurture entrepreneurial talent. By actively promoting the existing support mechanisms, the Alliance can create a more informed and engaged community around entrepreneurship. Additionally, targeted outreach efforts—such as informational sessions, webinars, and success story showcases—will reinforce the message of available opportunities and encourage participation.

Expected Impact: To position EUTOPIA as a leading point of reference for potential entrepreneurs, significantly increasing entrepreneurial activity across the Alliance. As more individuals engage with support programs, we anticipate heightened involvement from institutional leadership in fostering an entrepreneurial mindset. This initiative will ensure that aspiring entrepreneurs receive the necessary guidance and resources to succeed, ultimately enhancing the innovation landscape within the EUTOPIA Alliance.

Long-term recommendations

R#5 *Standardise Entrepreneurial Curriculum / Syllabus / Methodology*

Collaborate to develop a standardised entrepreneurial curriculum that can be adopted across all EUTOPIA member institutions. This curriculum should encompass a comprehensive range of modules focused on entrepreneurship fundamentals, technology transfer mechanisms, and practical skills for startup creation. Incorporating micro-credentials into this framework will allow students to gain recognised qualifications demonstrating their competencies. By aligning the curriculum with industry needs and best practices, we can ensure that students are

equipped with the essential knowledge and skills to thrive in entrepreneurial environments.

Expected Impact: To significantly enhance the competencies of both students and staff in entrepreneurial activities, fostering a more innovation-oriented academic culture. As a result, graduates will be better prepared to engage in entrepreneurship, leading to overall increased entrepreneurial engagement within the Alliance.

***R#6** Explore and create Incentives for Faculty-Industry Engagement*

Establish an incentive framework that rewards faculty members for actively engaging in industry collaborations, technology transfer activities, and entrepreneurship initiatives. This could involve creating recognition programs, providing funding opportunities, and considering such engagement in promotion decisions. By making industry collaboration a valued aspect of academic careers, EUTOPIA will send a strong signal to researchers and professors about the importance of these connections. Such incentives would motivate faculty to engage with the industry and increase the visibility of EUTOPIA as a collaborative and innovation-driven academic network.

Expected Impact: Implementing this framework will lead to more balanced professional careers for faculty, promoting their development and motivation for entrepreneurship. Enhanced engagement between academia and industry is likely to enrich the entrepreneurial landscape across the Alliance.

***R#7** Exploring a Shared Innovation Fund*

Initiate a shared funding mechanism within the EUTOPIA network to support high-potential entrepreneurial projects and spin-offs. This shared innovation fund would provide seed funding for innovative ideas with strong commercialisation potential, allowing for interconnectedness between various ecosystems and external funding sources. By establishing a clear avenue for financial support, EU-

TOPIA can effectively nurture the early stages of entrepreneurial ventures, ultimately stimulating growth and innovation.

Expected Impact: Establishing a shared innovation fund is expected to attract more resources and investors to the EUTOPIA network, enhancing its visibility and influence at the EU level. This funding will be a crucial catalyst for startup and entrepreneurship activities across member institutions.

R#8 *Enhance Technology Transfer Collaboration*

Create a repository, enabled by the central EUTOPIA website, of best practices, tools, and resources focused not only on technology transfer but also on broader entrepreneurial support initiatives. Encouraging member institutions to share their successes and challenges will facilitate streamlined processes across the Alliance and improve valorisation efforts. By aligning these efforts with previously mentioned opportunities, the collaboration will enhance overall effectiveness in supporting entrepreneurial endeavours.

Expected Impact: This initiative is expected to bolster the capacity of individual institutions to effectively support entrepreneurship among students and staff. Increased awareness of available resources and successful practices will empower academics and staff to make meaningful contributions in the entrepreneurial arena.

R#9 *Engage Local Communities and Stakeholders*

Foster strategic partnerships with local businesses, civic organisations, and government entities to create a supportive ecosystem for entrepreneurship within each member institution's community. These partnerships can offer valuable insights into real-world challenges, provide necessary resources, and identify potential funding opportunities for entrepreneurial projects. Engaging with local communities will also enhance the impact of prior

recommendations, ensuring a collaborative approach toward entrepreneurship.

Expected Impact: By engaging local communities and stakeholders, EUTOPIA institutions will become more entrepreneurial and open at the local level, acting as champions and hubs for entrepreneurial activities. This initiative will strengthen the Alliance's connection to societal challenges, enhancing its role as a leader in innovation and entrepreneurship.

5. Conclusions and Next Steps

The EUTOPIA Alliance stands at a pivotal juncture, ready to embrace a culture of entrepreneurship that can significantly enhance innovation and economic impact within its member institutions. By recognising the importance of collaborative efforts and shared best practices, the alliance can leverage its collective strengths to create a vibrant ecosystem that nurtures talent and drives transformational change. The recommendations outlined in this white paper provide a strategic framework for fostering entrepreneurship across the EUTOPIA member universities. By enhancing mentorship programs, standardising curricula, creating funding opportunities, and strengthening industry connections, the alliance can build a robust infrastructure that supports aspiring entrepreneurs and researchers.

Now is the time for action. To effectively drive these initiatives forward, we propose the following next steps:

* *Disseminate the White Paper recommendations:* share this white paper with all ten member universities of the EUTOPIA Alliance, ensuring that the insights and recommendations reach key stakeholders across each institution.

* *Engage Institutional Leadership:* invite university presidents, rectors and senior management teams to join the

ongoing dialogue about promoting entrepreneurship within their institutions. This engagement will be crucial in fostering commitment and mobilising resources at the highest levels.

* *Encourage Participation in the Connected Community:* create opportunities for faculty, staff, and students from each university to participate in the Connected Community on Entrepreneurship and Innovation. The alliance can inspire active contributions to the entrepreneurial initiatives proposed in this document by fostering a sense of ownership and collaboration.

* *Organise Initial Alignment Meetings:* schedule introductory meetings and workshops for institutional representatives to align on the recommendations and discuss implementation strategies. These sessions will serve as a platform for sharing experiences, identifying common challenges, and fostering inter-institutional collaboration.

* *Establish a Monitoring and Evaluation Framework:* develop a framework to monitor the implementation of the recommendations and evaluate their impact over time. This will involve gathering participant feedback and tracking key performance indicators to ensure the alliance is making meaningful progress towards its entrepreneurial goals.

* *Communicate Progress and Success Stories:* use EUTOPIA's communication channels to regularly share updates on the implementation of these initiatives, highlight success stories, and celebrate the achievements of entrepreneurial projects 20 within the alliance. This will help maintain momentum and encourage further participation from all stakeholders.

By taking these steps, the EUTOPIA Alliance can catalyse a transformative shift toward a culture of entrepreneurship that benefits individual universities and contributes to the broader European knowledge economy. However, at a certain point, we will need to secure additional resources—both financial support and personnel—to effectively manage the expectations and sustain the impact of these initial steps. Together, we can create a sustainable, innovative future that empowers the next generation of entrepreneurs and changemakers.

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The Role of Education in Boosting Entrepreneurship

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ABSTRACT

The relationship between education and entrepreneurship is an important issue for researchers and policymakers who seek to understand the mechanisms through which education influences entrepreneurial intentions. This paper contributes to a better understanding of entrepreneurial intentions by exploring this relationship through the framework of the theory of planned behaviour. The findings highlight the significant role of entrepreneurship education and financial knowledge in entrepreneurial intention, emphasising that policymakers should prioritise the development of skills and competencies that enhance self-efficacy, increase individuals' capacity to act, improve their ability to recognise business opportunities and reduce the fear of entrepreneurial failure in the current dynamic economic environment.

Introduction

Entrepreneurship education and training programmes focus on the development of entrepreneurial attitudes, skills and personality traits, and their courses aim to equip individuals with the tools to start a business (Fayolle, 2010). The Global Entrepreneurship Monitor (GEM) research program identifies entrepreneurship education as an issue of global economic and social importance with significant policy implications for all nations (Bosma et al., 2020). The GEM underscores that effective entrepreneurship education can foster entrepreneurial intentions, improve

the quality of entrepreneurial activities and contribute to economic development by equipping individuals with the necessary skills, knowledge, and mindset to create and sustain successful ventures. This makes it a critical focus for policymakers seeking to promote innovation, job creation, and economic growth.

Previous research on the impact of entrepreneurship education has found inconsistent findings. Most studies have shown that entrepreneurship education has a significant positive impact on self-assessed entrepreneurial skills and positively correlates with entrepreneurial intentions (Von Graevenitz et al., 2010; Deng and Wang, 2023; López-Muñoz et al., 2023), while other studies have shown that this effect is insignificant or even significantly negative for the intention to become an entrepreneur (Oosterbeek et al., 2010; Nabi et al., 2017).

In addition to entrepreneurship education, developing financial literacy is a key part of entrepreneurship. It can help potential entrepreneurs learn how to analyse market trends, prepare business plans and manage the financial risks of their business (Guo et al., 2024). According to Tran et al. (2024), lack of financial knowledge is among the top 5 and 10 reasons why start-ups fail, including inadequate financing, insufficient financial resources, and inability to raise capital. Studies on the relationship between financial literacy and entrepreneurship remain limited.

Based on the theory of planned behaviour (TPB) (Ajzen, 1991), this study uses data from the GEM Romania project to investigate the impact of entrepreneurship education and financial knowledge on entrepreneurial intention.

Entrepreneurial activity around the world

The Global Entrepreneurship Monitor (GEM) research project was initiated in 1999 by researchers at Babson College (USA) and London Business School (UK) to provide internationally comparable data on entrepreneurial

activity. Governments and other stakeholders need reliable and credible data to make decisions that foster entrepreneurship and healthy entrepreneurial ecosystems worldwide. The GEM project aims to collect data to measure the level of entrepreneurial activity in different countries, to understand how entrepreneurial activity evolves over time, and to explain why some countries have higher rates of entrepreneurial activity than others. Global Entrepreneurship Monitor is a consortium of national teams, primarily associated with top academic institutions, which carry out surveys around the world. Romania is represented by the team of the Faculty of Economics and Business Administration at Babeș-Bolyai University. The GEM is the only global research source that collects data on entrepreneurial activity directly from individual entrepreneurs. GEM's adult population survey (APS) analyses the characteristics, motivations and ambitions of individuals who start a business, as well as social attitudes towards entrepreneurship. The approach of the APS is to conduct a large, stratified random sample of at least 2,000 adults, reflecting the age, geographical location and male-female distribution of the adult population of each participating economy, ensuring that the survey is nationally representative. The GEM data can provide a reliable bias for international comparisons of the role of entrepreneurial activity in national economic growth (Reynolds et al., 2005). In 2023, the APS was conducted in 46 different economies around the world, collectively representing some 57% of the world's population and 70% of the global gross domestic product (GEM, 2023).

In recent years, there have been growing concerns about the adequacy of GDP as a measure of well-being, including an increasing concern about the distribution and sustainability of income within economies. Alternative indicators of well-being are gaining credibility. One alternative is the human development index (HDI) (GEM, 2023). The HDI includes indicators such as life expectancy,

formal education of the adult population and the school enrolment expectancy of children, in addition to elements such as income and quality of employment (United Nations Development Programme, 2019).

HDI often correlates with various aspects of economic behaviour, including entrepreneurship. Researchers analyse the link between entrepreneurial activity and human development to identify public policies encouraging entrepreneurship. Rani and Kumar (2021) demonstrated that entrepreneurial activities have a positive impact on human development in BRICS countries. However, Dvouletý et al. (2018) found no impact of entrepreneurship on the HDI. Activity is the total early-stage entrepreneurial activity (TEA) rate, which shows the share of adults in an economy who start or run a new business (GEM, 2023). Figure 1 shows the relationship between the total early-stage entrepreneurial activity rate and the human development index of the participating GEM countries in 2023.

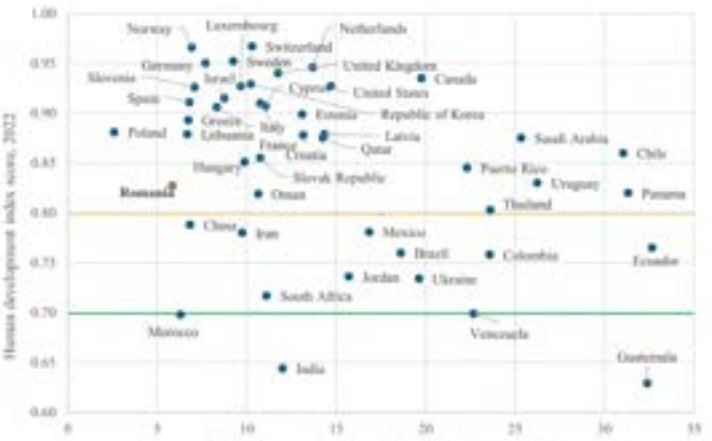

Fig. 1. Total early-stage entrepreneurial activity rates and the human development index scores in GEM participating countries, 2023 (orange and green line relevant HDI thresholds). Source: GEM APS (2023) and Human Development Reports (2023).

We can observe that most of the countries participating in the GEM have very high HDI score (more than 0.8, above the orange line). The EU countries participating in the GEM exhibit high human development index scores but low or average total early-stage entrepreneurial activity rates. We can observe that most of the countries participating in the GEM have very high HDI score (more than 0.8, above the orange line). Romania has a very high human development index score (HDI=0.83 in 2022) and one of the lowest TEA rates after Poland. Countries with high HDI scores have different TEA rates, with China having the lowest in this group and Ecuador having the highest TEA rate. Only four of the participating GEM countries have medium HDI score (less than 0.7, below the green line).

GEM (2023) classifies any person owning and managing a business paying wages or salaries for more than 42 months as an established business owner (EBO).

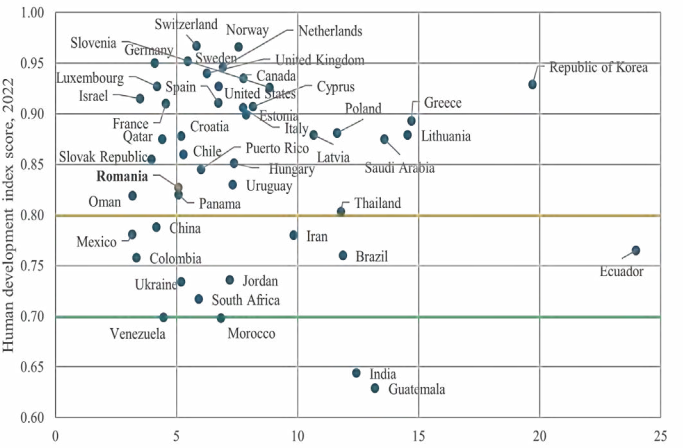

Fig. 2. The established business ownership rates and the human development index scores in GEM participating countries, 2023 (orange and green line relevant HDI thresholds). Source: GEM APS (2023) and Human Development Reports (2023).

Established businesses are also important in a dynamic economy, providing a large share of private sector employment and offering some stability in a changing world. Figure 2 illustrates the EBO rates and the HDI scores of the GEM participating countries in 2023. An interesting fact is that the EBO rates are below 15% in all but two countries. One of them is in the very high human development group (Republic of Korea), and the other in the high human development group (Ecuador).

Entrepreneurial attitudes and perceptions in Romania

Individuals are more likely to start and persist in a business if they perceive that they have the skills, knowledge and experience to start it, and if they are not discouraged by fear of failure (GEM, 2023). 5.8% of the Romanian adult population show an intention to start a business in the next three years and are potential entrepreneurs. This rate places Romania 43rd out of 46 countries in the 2023 survey.

In Romania, 55.7% of adults think that there are good opportunities to start a business in their area. With this rate, Romania ranks 24th out of 46 countries in the 2023 GEM survey. 52.6% of the adult population in Romania consider that they have the skills, knowledge and experience to start a new business. In the 2023 survey, Romania ranks 32nd for this indicator. 45.5% of adults know someone who has started a new business in the last two years. Romania is ranked 38th for this indicator. 59% of adults consider that fear of failure would prevent them from starting a new business. Romania is ranked 4th out of 46 countries according to fear of failure. The values of the indicators are shown in Figure 3.

How to stimulate entrepreneurship through education?

Several theories have been used in the literature to predict and understand human behaviour related to

Fig. 3. The entrepreneurial attitudes of entrepreneurs, potential entrepreneurs and others (who do not want to become entrepreneurs) in Romania, 2023. Source: GEM APS Romania database, 2023 for entrepreneurs (early-stage entrepreneurs and established business owners) and potential entrepreneurs, the proportion of individuals who see good business opportunities, those who think they have the skills to start a business and those who know any start-up entrepreneurs are much higher. In their case, the fear of failure is less of a barrier to starting a new business.

entrepreneurial intentions, the most widely used of which are: the theory of reasoned action (Fishbein and Ajzen, 1975), social cognitive theory (Bandura, 1989), and the theory of planned behaviour (Ajzen, 1985; Ajzen, 1991).

The theory of planned behaviour (TPB) has been widely used to explain the formation of entrepreneurial intention. The TPB posits that three components influence this intention: attitudes toward the behaviour refers to the degree to which a person has a favourable or unfavourable evaluation of the entrepreneurial behaviour, specifically to how positively or negatively an individual views the idea of starting a new business. If the individual believes that becoming an entrepreneur will lead to desirable outcomes, he or she is more likely to have a strong intention to pursue entrepreneurship. Subjective norms involve the perceived social pressure to perform or not perform the behaviour. It reflects how much influence the opinions of important

people (like family, friends, mentors, or society as a whole) have on the individual's decision to become an entrepreneur. If a person believes that important people in their life think they should become an entrepreneur, are more likely to have a stronger intention to become an entrepreneur. Perceived behavioural control refers to the perceived ease or difficulty of performing a behaviour and is like the concept of self-efficacy (Ajzen, 1991). In entrepreneurship, this would be the confidence the individual has in their ability to start and run a business. Higher perceived behavioural control increases the likelihood that the individual will intend to become an entrepreneur.

Attitudes towards entrepreneurship are measured in different ways in the literature. Studies using GEM data have measured entrepreneurial attitudes by taking into account both positive and negative aspects (e.g. Tsai et al., 2016; Middermann, et al., 2020; López-Muñoz et al., 2023). People who perceive good opportunities to start a business in the region where they live are more likely to expect to create a successful new business and have a positive attitude towards entrepreneurship. People who think that fear of failure would prevent them from starting a new business are less likely to be interested in developing a new business and will not have a positive attitude towards entrepreneurship.

The subjective norms concerning business activity can be measured using GEM data with the following question: "Do you know someone personally who started a business in the last two years?" (Kolvereid, 2016; Schmutzler et al., 2018; Middermann et al., 2020; López-Muñoz et al., 2023). This allows us to measure the impact of the immediate business environment, the business culture of the region, on the entrepreneurial decision.

In the literature, perceived behavioural control using GEM data has been measured with the item: "I have the skills and abilities necessary to be successful as an entrepreneur" (Kolvereid, 2016; Schmutzler et al., 2018;

Middermann et al., 2020; López-Muñoz et al., 2023; Morales-Alonso et al., 2024).

The analysis shows that among the entrepreneurial attitudes in Romania, fear of failure has a negative impact on entrepreneurial intention, while the recognition of opportunity increases entrepreneurial intention. The subjective norm, measured by knowing other entrepreneurs, also has a positive effect on entrepreneurial intention, since this social network would assert pressure to engage in entrepreneurial activity. Perceived behavioural control, i.e. the perceived entrepreneurial skills, also have a significant positive effect on intention for entrepreneurship. Individuals who think they have the skills, knowledge and experience to start a business are more likely to become entrepreneurs.

Souitaris et al. (2007) found that whereas knowledge and resources could increase the likelihood of success for those who start a new venture, it is the inspiration that raises attitude and intention and increases the chances that individuals will eventually attempt an entrepreneurial career. Business education programs improve the capacity of individuals for entrepreneurial intention, as they improve their ability to discover and exploit opportunities. According to El Boury and Qafas (2022), the role of the university and entrepreneurship education does not have a direct impact on entrepreneurial intention, but is mediated by the attitude toward behaviour, subjective norms, and perceived behavioural control. Dileo and García Pereiro (2019) argues that the possession of human capital, with skills due to general education, entrepreneurial, economic and managerial education, also plays an important role in the decision of starting a new business. López-Muñoz et al. (2023) found that individuals who receive entrepreneurship education develop basic entrepreneurial knowledge, skills and attitudes. Figure 4 shows the association between the different type of entrepreneurial education and training and the attitudes

toward behaviour, subjective norms and perceived behavioural control.

Fig. 4. Association between entrepreneurial education and training and the antecedents of business start-up intentions in Romania, 2023. Source: own calculations based on GEM Romania APS database, 2023.

Results show that people who have received training in business financial management, entrepreneurship or personal finance, or who have studied business, economics or finance as part of their school or university education, have a positive attitude towards entrepreneurship, are less afraid of failure, are more likely to recognise opportunities, have a wider network of contacts and are more confident that they have the knowledge and skills to start a new business, and therefore have higher expectations of success in starting new businesses.

In this study, we used an entrepreneur's self-assessed degree of financial knowledge. Self-assessed financial knowledge could be considered a component of entrepreneurial human capital (Engström and McKelvie, 2017; Alperovych et al., 2023). Figure 5 shows the relationship of financial knowledge with attitudes towards behaviour, subjective norms and perceived behavioural control. According to the literature, higher levels of financial knowledge are associated with higher levels of attitudes toward entrepreneurship, perceived behavioural control, and subjective norms.

Fig. 5. Association between financial knowledge and the antecedents of business start-up intentions in Romania, 2023. Source: own calculations based on GEM APS Romania database, 2023.

Conclusions

There is an increased interest among policymakers and educators in the importance of entrepreneurship education and financial literacy (Arthur, 2018). This study used the Global Entrepreneurship Monitor (GEM) adult population survey (APS) 2023 to analyse the intention of the adult population in Romania to start a business. The theory of planned behaviour was used to identify factors influencing the start-up creation, which emphasises that potential entrepreneurs should have an attitude towards a new venture influenced by social norms, respectively supported by opportunity recognition and access to resources. The study examines the impact of entrepreneurial education and financial knowledge on factors influencing entrepreneurial intentions.

Entrepreneurship education and training support individuals to start a new business by providing essential entrepreneurial knowledge, skills and attitudes such as creativity, initiative, perseverance, teamwork, risk-taking and responsibility (López-Muñoz et al., 2023). The results of the study show that individuals who have received entrepreneurship education and training are less afraid of failure, see more opportunities to start a new business, and a higher proportion of them believe they have the skills and

abilities to start a business and know more about new entrepreneurs. Therefore, as López-Muñoz et al. (2023) have shown, investing in entrepreneurship education is one of the most profitable activities policymakers can engage in. These results demonstrate the importance of further support for entrepreneurship education.

Financial literacy is also an indicator of an individual's entrepreneurial competence as well as a precondition for entrepreneurship. Financial literacy refers to individuals' proficiency in overseeing funds, which aids them in forecasting future scenarios and making informed decisions. Entrepreneurs must have extensive knowledge of the financial resources available to them to navigate the complex environment of financial markets (Guo et al., 2024). Our results show that individuals with higher financial knowledge have a lower fear of failure and higher confidence in their entrepreneurial skills. This indicates the importance of programmes and initiatives to increase financial knowledge.

As the results of the study show, entrepreneurship education should focus on strengthening skills and competencies that increase self-efficacy, foster individual capacity for action and better recognition of business opportunities, reducing the fear of entrepreneurial failure. Policymakers can develop concrete actions focusing on financial and entrepreneurial education to foster innovation, new business creation, and human resource development and, therefore, improve the economic development of regions.

Universities can play a key role in shaping this strategy. The example of Babeș-Bolyai University in Cluj-Napoca (Romania) demonstrates how research findings, such as those derived from the GEM project, can serve as a foundation for impactful policy decisions. Reflecting the insights discussed in this article, the Babeș-Bolyai University has implemented a three-tier system designed to provide essential education and training, supporting its students' entrepreneurial aspirations and initiatives.

First, the university has integrated a cross-curricular course titled "The Basics of Entrepreneurship" into the curriculum for all students, regardless of their field of study (including business and non-business-related). This course aims to bridge the gap between academia and the entrepreneurial world, making entrepreneurship more accessible to students across diverse disciplines. Second, beyond this foundational knowledge available to a broad range of students, the university and its faculties have established several organisations that offer a more in-depth, practical understanding of entrepreneurship. These organisations are tailored for students more likely to develop strong entrepreneurial intentions, providing them with the necessary tools and, most importantly, relevant practical experiences. Third, building upon the programs offered by these dedicated organisations, the university has also launched a business incubator, the UBB Student i-Lab. This incubator plays a pivotal role in guiding students from initial entrepreneurial ideas to fully developed business plans ready for market implementation. The UBB Student i-Lab is, in fact, a crucial component in helping students transition into influential leaders in the business world.

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The Influence of Pedagogues on the Development of an Entrepreneurial Mindset

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Instead of an introduction

I recently read the *Eurydice* report published by the Education, Audiovisual and Culture Executive Agency (EACEA, Education and Youth Policy Analysis, European Commission/EACEA/Eurydice, 2022). The report emphasises that school education is inconceivable without teachers, who are an essential driving force behind the learning process in any education system. Teachers are at the centre of students' education, guiding their development and helping them acquire the knowledge and skills necessary for their future lives as individuals.

Beyond academic teaching, teachers also impart social skills, values and behaviours that enable young people to become active and responsible citizens. They play a major role in influencing students' motivation and inspiration, which has a significant impact on their performance. Teachers have a huge responsibility when it comes to helping young people develop the knowledge, skills and values they need to realise their full potential—not only as students but also as future citizens.

High-quality teachers are a cornerstone of any successful education system. They inspire and motivate students from diverse backgrounds and prepare them to adapt to a rapidly changing world. When I think about this, I realise the immense responsibility I have every time I step into the laboratory or lecture room, standing among inquisitive students.

Despite this vital role, however, the same report also highlighted a growing problem: There is a shortage of teachers in many European education systems. This shortage can seriously affect the ability to deliver high-quality teaching and learning, and this realisation has stayed with me.

Reading goes further

European policy emphasises the importance of providing researchers, especially young scientists, with the skills they need to pursue careers outside academia or to set up businesses, thus broadening their career opportunities, including in the private sector. According to the 2022 report *Knowledge Ecosystems in the New ERA – Using a Competence-based Approach for Career Development in Academia and Beyond* (European Commission, 2020), doctoral students are often not sufficiently trained in transversal skills during their doctoral programme. These skills, crucial for intersectoral mobility, can strengthen research careers and make them more attractive by opening opportunities in other sectors and addressing the precarity many early career researchers face, as they are often employed in short-term, grant-funded positions with little prospect of permanent or continuous employment.

Despite the progress made through reforms in the assessment of research careers, such as the *Agreement on Reforming Research Assessment* (Agreement on Reforming Research Assessment, 2022), which promotes the recognition of a broader range of skills and talents, there is still a need for greater recognition of transversal skills in the assessments of researchers. This would better support interdisciplinary research and facilitate the transition of researchers into roles outside academia, including entrepreneurship and innovation.

A major obstacle to this progress is the current narrow approach to evaluating researchers, which relies heavily on peer-reviewed publications and the impact factor of journals. This limited metric discourages researchers from

engaging in activities such as open science, cross-sector mobility, entrepreneurship, citizen science, and outreach, as these endeavours are seen as having little relevance for advancement in academic careers.

The European Commission published *ResearchComp* (European Commission, 2022), the first EU Competence Framework for Researchers, which is a key initiative in the European Year of Skills (2023) (https://year-of-skills.europa.eu/index_en). In line with the *Communication on the New European Research Area for Research and Innovation* (European Commission, 2020) and the *European Skills Agenda* (https://ec.europa.eu/social/main.jsp?catId=1223&langId=en) adopted by the Commission in 2020, this framework aims to equip researchers with a set of transversal skills that are important for careers in different sectors, including academia, business, industry, public administration, and entrepreneurship, e.g. developing their start-ups.

Reflecting on this initiative has led me to consider its wider implications. The *ResearchComp* framework and the broader European focus on transversal skills reveal a significant trend: the recognition that education should not only prepare students for traditional academic paths but also dynamic and entrepreneurial careers in a rapidly changing world. This shift in focus emphasises the growing need to nurture versatile, adaptable individuals who can succeed in a variety of fields, from academia to industry, public administration, and entrepreneurship.

However, this approach should not be limited to doctoral students or early-career researchers. The development of transversal skills—such as critical thinking, problem-solving, communication, and adaptability—must begin much earlier in a student's education, especially at the bachelor's and master's levels. Students are still developing their professional identity and exploring career options at these stages. A major obstacle to this progress is the current narrow approach to evaluating researchers, which relies heavily on peer-reviewed publications and the impact factor of

journals. This limited metric discourages researchers from engaging in activities such as open science, cross-sector mobility, entrepreneurship, citizen science, and outreach, as these endeavours are seen as having little relevance for advancement in academic careers.

In essence, the process of learning and recognising skills should begin early to build a solid foundation that will enable students to continually develop and refine their competencies throughout their studies and careers. By prioritising and developing transversal skills at Bachelor's and master's levels, educational institutions can produce graduates who are not only prepared for academic success but who can also thrive in a fast-paced, entrepreneurial world.

The role of educators in fostering entrepreneurial thinking

Educators are in a unique position to promote an entrepreneurial mindset. From elementary school teachers who foster curiosity and resilience to university professors and mentors who provide the tools for independent, creative problem-solving, educators are the catalysts for shaping future innovators and entrepreneurs. Their influence goes far beyond the dissemination of knowledge (Reis, 1997). They encourage critical thinking, adaptability, and a proactive approach to challenges—qualities that are essential for entrepreneurship.

To achieve this, educators themselves must embody entrepreneurial qualities: flexibility, creativity, and a willingness to explore new teaching methods that encourage risk-taking and innovation. It is not enough to simply teach the theories of entrepreneurship. Students must have the opportunity to apply what they have learnt in real-life contexts, be it through projects, internships, or collaboration with industry. This practical application of knowledge encourages students to develop solutions to complex problems, test their ideas, and learn from failure, which are all key elements of entrepreneurial thinking. A crucial factor

in fostering this mindset is careful preparation by educators. Lessons and activities must be designed to engage students, challenge their thinking, and stimulate their creativity. Planning should consider the academic content and the learning processes that promote autonomy and problem-solving.

For example, by preparing tasks that allow students to take ownership of their projects, educators can give them a sense of responsibility and innovation, similar to entrepreneurs' experiences.

Providing quality feedback and feedforward is equally important for the development of entrepreneurial skills. Feedback should go beyond correcting mistakes and feedforward should stimulate reflection, lead to improvement, and encourage students to experiment with new ideas. Constructive, timely feedback helps students understand the impact of their decisions and approaches and allows them to refine their thinking and build resilience. When students receive thoughtful feedback that recognises their efforts and creativity, they are more likely to persevere in the face of challenges.

Moreover, student-centred learning is an effective approach to promoting entrepreneurial thinking. This method shifts the focus from passive absorption of information to active participation, allowing students to take control of their learning. By giving students the autonomy to explore their interests, collaborate with peers, and pursue projects that resonate with them, educators can create an environment where entrepreneurial ideas can flourish. In a student-centred classroom, learners are encouraged to identify opportunities, take initiative, and experiment with solutions.

Reverse teaching, or flipped classrooms, also plays a role in promoting entrepreneurial thinking. In this model, students engage with course content outside of class—through reading, videos, or online resources—while class time is dedicated to active problem-solving, discussions,

and collaborative projects. This approach shifts the responsibility for learning to students and encourages them to prepare, ask questions, and explore topics in class. By giving students more control over their learning process and focusing class time on interactive, hands-on experiences, reverse teaching encourages independent thinking and collaboration.

Instead of a conclusion: a call to action for educators

To summarise, educators at all levels have a critical role in developing their students' entrepreneurial mindset. As the demands of the 21st-century economy continue to evolve, equipping learners with the ability to think creatively, take initiative, and adapt to new challenges will be critical to their success. Whether in schools, universities, or research, teachers must embrace their role as facilitators of innovation and recognise that their influence extends far beyond the classroom or laboratory.

To truly fulfil this responsibility, the education system must take a comprehensive approach that educates students holistically — not just in specific subject areas. Each student is an individual with unique strengths, interests, and needs. A one-size-fits-all model is not suited to nurturing the different talents in a classroom. By recognising and accommodating these individual differences, educators can create a more inclusive environment that fosters entrepreneurial thinking tailored to the aspirations of each learner.

This means that interdisciplinary approaches need to be integrated, allowing students to explore different areas and encouraging them to make connections between different topics and real-world applications. In addition, personalised learning pathways and mentoring opportunities can help students discover their passions and develop the necessary skills to pursue them effectively.

By nurturing the entrepreneurial spirit of the next generation, educators are preparing students not only for

careers but also to become leaders, innovators, and creators in an ever-evolving world. This comprehensive approach to education will empower students to utilise their unique skills and pursue their goals with confidence, ultimately contributing to a more dynamic and innovative society.

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From Chaos to Creativity: COVID-19's Acceleration of Frugal Innovation Ecosystems in the EUROMED Zone

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ABSTRACT

The COVID-19 pandemic has catalyzed an unprecedented global crisis, exposing vulnerabilities in healthcare systems and supply chains. This article explores the rise of frugal innovation and entrepreneurial initiatives as vital responses to critical shortages in medical supplies and equipment. Through an analysis of various case studies, we illustrate how the principles of jugaad innovation, open-source collaboration, and grassroots entrepreneurship were harnessed to address urgent needs during the pandemic, particularly within the EUROMED zone. This study highlights the potential of these approaches to foster rapid, cost-effective solutions in resource-constrained environments and discusses their implications for future crisis response strategies and innovation policies. *Keywords:* COVID-19, frugal innovation, entrepreneurship, EUROMED, crisis response, open-source collaboration.

Introduction

The emergence of COVID-19 in late 2019 has profoundly impacted global health systems, economies, and societies (World Health Organization, 2020). As the virus spread rapidly across continents, healthcare providers faced critical shortages of essential equipment, including personal protective equipment (PPE), ventilators, and sanitizing products (Ranney et al., 2020). These shortages prompted a wave of innovative responses from a diverse array of actors,

including entrepreneurs, makers, and citizen scientists. In particular, Europe and the broader EUROMED zone emerged as hotbeds of innovative solutions, demonstrating the region's adaptability and collaborative spirit. This article examines the role of frugal innovation and entrepreneurial initiatives in addressing the challenges posed by the COVID-19 pandemic, focusing on the following research questions:

* *How have the principles of frugal innovation been applied to mitigate medical supply shortages during the COVID-19 pandemic?*

* *What role has open-source collaboration played in facilitating rapid innovation and knowledge sharing?*

* *How have grassroots entrepreneurial efforts contributed to crisis response and mitigation?*

2. Theoretical Framework

2.1 Frugal Innovation and Jugaad. Frugal innovation refers to the process of simplifying and reducing the cost of goods and their production, particularly in resource-constrained environments (Zeschky et al., 2011). Central to this concept is *jugaad,* a Hindi term that embodies the essence of crafting resourceful solutions with limited means, especially in times of extreme scarcity (Radjou et al., 2012). As traditional supply chains buckled under global demand, frugal innovators worldwide, particularly in the EUROMED zone, demonstrated that impactful ideas often arise from constraints.

2.2 Open Innovation and Collaborative Intelligence. Open innovation involves leveraging external ideas and resources within a company's innovation process (Chesbrough, 2003). In crisis contexts, this concept extends to collaborative intelligence, where diverse groups of individuals and organ-

izations combine their knowledge and resources to rapidly tackle complex challenges (Malone et al., 2010).

3. Methodology

This study employs a qualitative multiple-case study approach to explore frugal innovation and entrepreneurial responses to the COVID-19 pandemic, particularly in the EUROMED zone. Data were collected from secondary sources, including news reports, press releases, and social media platforms. Cases were selected based on their relevance to addressing medical supply shortages and their embodiment of frugal innovation principles.

4. Findings and Discussion

4.1 Frugal Innovation in Medical Supply Production

4.1.1 The Snorkel Mask Miracle (Italy). In Italy, Dr. Renato Favero partnered with the 3D-printing firm Isinnova to transform ordinary snorkel masks into life-saving ventilator components. This ingenious solution, born from necessity, spread across Europe and beyond. The team's decision to make their blueprints freely available online sparked a global movement of makers producing similar adaptations, exemplifying the spirit of open collaboration (Isinnova, 2020).

4.1.2 The Open-Source Ventilator Project (Ireland). In Ireland, the Open-Source Ventilator project mobilized over 300 volunteers to design a low-cost, easy-to-produce ventilator in record time. This initiative demonstrated Europe's strong tradition of open-source collaboration and rapid prototyping, resulting in a working prototype within a week—testifying to the power of collective intelligence and the EU's diverse expertise (Pollard et al., 2020).

4.1.3 LVMH's Agile Pivot (France). Luxury giant LVMH exhibited remarkable agility by repurposing its perfume production lines to produce hand sanitiser for French hospitals. This swift response highlighted how established European companies could adopt an entrepreneurial mindset during crises, leveraging existing resources for the public good (Berardi et al., 2020).

4.1.4 The 3D Printing Revolution (Pan-European). As healthcare workers faced critical shortages of PPE, a pan-European army of makers with 3D printers stepped in. Initiated by Prusa Research in the Czech Republic to print face shields, this effort quickly expanded into a continent-wide movement, creating a decentralized manufacturing network that rapidly produced and distributed protective gear (Prusa, 2020).

4.2 Grassroots Innovation in the EUROMED Zone

4.2.1 Project OpenAir (Portugal and Beyond). Initiated in Portugal, Project OpenAir grew into a global network of over 15,000 volunteers focused on developing open-source solutions for medical hardware, including ventilators and PPE. This project exemplified how European ingenuity could spark global collaboration, with contributions flowing from across the continent and beyond.

4.2.2 Hands-Free Door Handles (Finland). In Finland, the small 3D printing company Materflow designed and shared plans for hands-free door handle attachments to reduce surface transmission of the virus. This simple yet effective solution spread rapidly across Europe, demonstrating how small businesses could significantly impact through open innovation.

4.2.3 UIR's Frugal Innovation: A Beacon of Hope Amidst the Pandemic (Morocco). Recognising the critical importance of

fostering resilience, the International University of Rabat (UIR) distinguished itself as a notable locus for this capacity. This development was a direct outcome of the innovative impetus strategically spearheaded by Pr. Benjouad, Vice-President of Research, Innovation and Partnerships, and Pr. Bouya, Director of the Centre of Innovation and Entrepreneurship. Researchers and students developed the "COVID-19-T-Members" mobile application, which integrated GNSS tracking, BLE communication, and QR code functionality for user identification at smart disinfection units. Additionally, UIR utilised drones for rapid and contactless delivery of supplies, showcasing creative solutions in a challenging environment. Volunteers produced over 18,000 respiratory masks and protective visors through 3D printing, demonstrating the power of local action supported by organisations like ICESCO.

5. Implications and Future Research

The COVID-19 pandemic has underscored the importance of frugal innovation and grassroots entrepreneurship in crisis response. From the lessons learned during this period, we can identify key principles for future innovation:

* *Embrace Constraints.* Limitations can breed creativity, as seen in snorkel mask innovations.

* *Collaborate Openly.* Open-source collaboration accelerates innovation, as exemplified by the Irish ventilator project.

* *Think Frugally.* Create maximum value with minimum resources, as demonstrated by the 3D printing movement.

* *Stay Agile:* The ability to pivot quickly is crucial, as shown by LVMH's rapid shift to sanitiser production.

* *Prioritise Impact.* Focus on making a meaningful difference, evident in all European initiatives.

* *Harness Cross-Sector Collaboration.* Partnerships like that of Decathlon and BIC highlight the power of unexpected alliances.

* *Leverage Existing Networks.* Europe's strong maker and open-source communities proved invaluable.

* *Embrace Rapid Prototyping.* Quick iteration and testing were key to the success of many projects.

* *Foster a Pan-European & Cross-Cultural Approach.* Collaboration across borders amplified the impact of local innovations.

* *Balance Innovation with Regulation.* Europe's approach illustrated how to rapidly innovate while maintaining safety standards.

* *Harness startup research to pivot from a cost-centric approach to a growth-oriented model* where early-stage technologies and spinouts can eventually generate new revenues for short-funded universities, incubators, etc.

6. Conclusion

The COVID-19 pandemic has acted as a catalyst for frugal innovation and entrepreneurial responses globally, particularly in the EUROMED zone. This study underscores the promise of these approaches to address critical needs during crises. The innovative spirit demonstrated across the region has not only saved lives but also paved the way for a new paradigm in crisis response and innovation.

The case studies presented highlight the power of collaborative intelligence, frugal, and open-source approaches

in rapidly addressing urgent needs. From the transformation of snorkel masks into ventilator components in Italy to the development of smart applications and 3D-printed PPE in Morocco, these initiatives showcase the ingenuity and resilience of the EUROMED region. Moreover, the pandemic has accelerated the adoption of digital technologies and remote collaboration tools, enabling a more connected and agile innovation ecosystem. This shift has the potential to democratize innovation, allowing a broader range of actors to contribute to solving regional and global challenges.

As we move forward, integrating these lessons into broader innovation and crisis preparedness strategies will be crucial for fostering resilience and adaptability in the face of future global challenges. Policy makers and business leaders should consider how to:

* Foster an ecosystem that supports frugal innovation and rapid prototyping

* Encourage cross-sector and cross-border collaboration

* Invest in digital infrastructure to support remote collaboration and open innovation

* Develop flexible regulatory frameworks that balance innovation with safety and quality standards

* Incorporate lessons from grassroots initiatives into formal crisis response plans

The legacy of these pandemic pioneers offers a roadmap for harnessing impactful entrepreneurship to build a more resilient, sustainable, and equitable world. By embracing the principles of frugal innovation, open collaboration, and agile problem-solving demonstrated during the COVID-19 crisis, the EUROMED region can position itself at the forefront of innovation and crisis preparedness.

Future research should focus on quantifying the impact of these frugal innovations, exploring how to scale successful initiatives, and investigating the long-term effects of crisis-driven innovation on regional innovation ecosystems. Additionally, studies comparing the EUROMED zone's approach to other regions could provide valuable insights into best practices for global crisis response and innovation policy.

In conclusion, the COVID-19 pandemic, despite its devastating effects, has revealed the extraordinary potential of human ingenuity and collaboration. The frugal innovations and entrepreneurial spirit showcased in the EUROMED zone during this crisis provide a powerful template for addressing future global challenges. By continuing to nurture this spirit of innovation and cooperation, we can build a more resilient and adaptive global community, better prepared to face whatever challenges the future may hold.

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Bridging Science Diplomacy and Entrepreneurship

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Introduction

Science diplomacy and entrepreneurship are often discussed as separate domains, yet their intersection offers transformative potential for addressing global challenges. This article explores how entrepreneurial initiatives can serve as powerful instruments of science diplomacy through advancing international cooperation, economic development, and technological progress. Using the traditional tripartite framework of science diplomacy, the article highlights how science-driven enterprises contribute to cross-border dialogue and benefit from international policy frameworks. Through case studies such as EcoPeace Middle East's environmental diplomacy, d.light's role in energy access and international development, and SpaceX's geopolitical influence, this study illustrates how scientific entrepreneurship can shape diplomatic landscapes. The analysis underscores the growing importance of entrepreneurial science diplomacy in a rapidly evolving geopolitical context. While innovation and international cooperation may seem like natural allies, challenges such as political tensions and regulatory barriers require a strategic and pragmatic approach. It argues that universities, policymakers, and international organisations should recognise and support the integration of entrepreneurship into science diplomacy because of the inherent potential to drive sustainable development, strengthen global ties, and navigate an increasingly complex world.

What is entrepreneurship?

Entrepreneurship is about identifying opportunities, taking risks, and mobilising resources to create and scale innovative solutions that address challenges or meet societal needs. It is a key driver of economic growth and technological advancement, with the potential to reshape industries, communities, and civilisations. Schumpeter's perspective (as discussed by Bull & Willard, 1993) frames entrepreneurship as a process of creating value by introducing new combinations of resources that disrupt the status quo and drive economic transformation. Hébert and Link (1989) define entrepreneurs as individuals who specialise in making pivotal decisions about the allocation and use of resources, emphasising their role in shaping markets and institutions. Gartner (1990) highlights that while a singular definition of entrepreneurship remains elusive, the field is characterised by themes such as innovation, value creation, growth, and the management of unique ventures. There is also social entrepreneurship, characterised by a blend of social and financial objectives, a commitment to community values, and a focus on innovation (Alegre et al., 2017). Our understanding of entrepreneurship as we move forward is inspired by all the aforementioned definitions.

What is Science Diplomacy?

Science diplomacy, on the other hand, is a platform uniting science, technology, innovation, and international relations, providing a framework for applying science and scientific channels in pursuit of foreign policy objectives (Fägersten, 2022). It is defined as a field that can both promote national competitiveness/security and facilitate multilateral responses to shared global issues such as climate change and pandemics (Melchor, 2020; Van Langenhove & Piaget, 2024). Over the past decade, its importance has grown as the role of science in tackling international

challenges has become more evident, necessitating its integration into foreign policy and international relations (Turekian, 2018). Beyond its formal mechanisms, science diplomacy also encompasses informal roles played by scientists and scientific organisations. These actors contribute to advancing diplomatic goals by forging dialogue and collaboration across borders, which is critical for addressing issues affecting the global commons (Gluckman, 2022). However, it must be said that science diplomacy's emphasis on solving global problems and collaborating with like-minded individuals across diverse national and cultural contexts often creates unrealistic expectations (Flink, 2020; Robinson & Olšákovám, 2024). This overburdened view can obscure the challenges inherent in navigating differing interests, values, and power dynamics on the global stage.

According to the hitherto preeminent conceptualisation framework of science diplomacy, advanced in 2010 by the Royal Society and the American Association for the Advancement of Science (AAAS), it involves leveraging scientific collaboration to build bridges between nations (science for diplomacy), using scientific knowledge to inform diplomatic decision-making (science in diplomacy), and facilitating international partnerships to advance scientific progress (diplomacy for science). This framework will apply to this article.

Why Bridge the Two?

Highlighting the connection between entrepreneurship and science diplomacy is important because it showcases how innovation can serve as a tool for addressing complex global challenges while nurturing international collaboration. Issues like climate change, global health crises, and digital transformation require both creative solutions and cooperative efforts that transcend borders. This article will explore how entrepreneurial initiatives fit within the Royal Society and AAAS' tripartite framework of

science diplomacy in hopes of illustrating their potential to address pressing global challenges while building mutual understanding and trust across borders. Through the examination of examples where entrepreneurial ventures have leveraged scientific expertise internationally, we aim to highlight the transformative power of entrepreneurship in strengthening global ties.

Entrepreneurial Science FOR Diplomacy

Science FOR diplomacy refers to the use of scientific collaboration and engagement as a vehicle for diplomatic outreach and trust-building. This kind of science diplomacy can appear in various forms, such as scientists serving as track II (i.e. unofficial) diplomats and exhibitions that showcase scientific achievements and build soft power. Such initiatives are particularly important in the absence of peaceful relations between countries. Entrepreneurial science For diplomacy is thus the entrepreneurial initiatives of a scientific nature that help build bridges between nations.

A very good example of entrepreneurial science FOR diplomacy is EcoPeace Middle East. Founded in 1994 by Jordanian, Israeli, and Palestinian environmentalists, this NGO uses shared environmental challenges – particularly water management – as a platform for facilitating dialogue and cooperation in a region burdened by war and political animosities. Their initiatives include advancing equitable water allocations between Israel, Palestine, and Jordan, addressing Gaza's critical water and sanitation crisis, and promoting the concept that regional water cooperation carries low political cost but high political gain. This bold social entrepreneurial approach has earned EcoPeace numerous accolades, including the Euro Solar Award and the Energy Globe Award, and even a nomination for the 2024 Nobel Peace Prize. Science-driven social entrepreneurship, as this initiative shows, can transcend political divides and turn shared environmental challenges into opportunities for

cooperation. While EcoPeace cannot solve the Middle East's crises alone, it is a model to be emulated at scale to help maintain or rebuild bridges in a fractured region. Global challenges are becoming increasingly interconnected while political systems grow increasingly at odds, highlighting the importance of such initiatives in offering a blueprint for using scientific collaboration to build trust, promote peace, and drive sustainable development across borders.

Another compelling example is the Middle East Entrepreneurs of Tomorrow (MEET) initiative. Since 2004, MEET has, in partnership with the Massachusetts Institute of Technology, provided top-performing Israeli and Palestinian high school students with training in computer science, entrepreneurship, and leadership. The program builds, through providing space and equipping these young entrepreneurs with critical skills, common ground between communities politically and odds and prepares them to drive meaningful, long-term change. These entrepreneurial science FOR diplomacy examples showcase the power that science, technology, and innovation hold in providing space for dialogue and cooperation across political and cultural divides. By addressing shared challenges — whether environmental sustainability, resource management, or technological advancement — these initiatives create neutral spaces where collaboration can thrive despite conflict and frigid diplomatic relations.

Entrepreneurial Science IN Diplomacy

Science IN diplomacy refers to the integration of scientific expertise within diplomatic efforts. This can manifest through scientific advisors in ministries of foreign affairs, scientific attaches in diplomatic missions, or the involvement of scientists in diplomatic negotiations. Entrepreneurial science IN diplomacy involves initiatives where science-based entrepreneurship affects and/or enhances diplomatic strategies and objectives.

One illustrative example of entrepreneurial science IN diplomacy is that of d.light, a social entrepreneurial startup founded in 2007 dedicated to providing affordable, renewable energy solutions to underserved populations. The goal is "to bring clean and affordable power to one billion people by 2030" (Tozun, 2024). So far, the company can boast of 193 million people helped through access to renewable energy while offsetting 40 million tonnes of CO2. Its founder, Nedjip Tozun, frequents global events like the World Economic Forum, an important vector in diplomatic agenda setting. Government agencies, such as the US Agency for International Development and the UK Department for International Development, have partnered with d.light to expand solar energy access, which showcases how entrepreneurial initiatives play a role in diplomatic priorities (USAID, 2024). ReNew Power, another startup, focuses on producing wind and solar energy for poor communities. It is represented by its founder, Sumant Sinha, at diplomatic events like the United Nations' climate summits (Sinha, 2023), further illustrating the roles that entrepreneurial projects play in science diplomacy. Both ReNew Power and d.light play an important role in advancing global sustainability efforts and contributing to the achievement of the United Nations Sustainable Development Goals (SDGs), particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action). Expanding access to renewable energy and reducing carbon emissions demonstrates that these enterprises support global commitments under the Paris Climate Agreement while facilitating sustainable development in underserved communities.

Of course, one cannot discuss entrepreneurial science IN diplomacy without mention of Elon Musk. Through companies like SpaceX, Tesla, and Neuralink, Musk has significantly influenced international diplomatic discourse on space governance, energy security, and technological innovation. SpaceX, for instance, has played a pivotal role in redefining space diplomacy (Vivek, 2024). Its Starlink

satellite network, initially launched as a commercial venture, has become a strategic asset in geopolitical crises, notably in Ukraine, where it has provided secure communication channels amid the conflict (Lo Nostro, 2024). Musk himself, who is now leading the Trump administration's Department of Government Efficiency, has used his high profile, fashioned by entrepreneurial pursuits and propagated by his X platform, to build relations with leaders such as Argentina's Javier Milei, India's Narendra Modi, and Italy's Giorgia Meloni (Mac et al., 2024). This case highlights how private scientific ventures can feed directly into the diplomatic and security arenas.

Beyond space and energy, biotechnology and health entrepreneurship have also emerged as key elements of entrepreneurial science in diplomacy. The rapid development and global distribution of mRNA vaccines against COVID-19 by companies such as BioNTech and Moderna demonstrated how entrepreneurial scientific innovation can shape international health diplomacy. Government collaborations, such as the COVAX initiative, facilitated vaccine equity discussions at diplomatic levels, reinforcing the role of science-driven enterprises in global governance (Storeng et al., 2021).

Diplomacy FOR Entrepreneurial Science

Diplomacy FOR science refers to diplomatic efforts that create favourable conditions for scientific collaboration through bilateral agreements, international research infrastructures, or cross-border funding initiatives. This form of diplomacy has historically facilitated large-scale scientific projects, such as the establishment of CERN or the International Thermonuclear Experimental Reactor. Diplomacy FOR entrepreneurial science, in turn, focuses on the diplomatic mechanisms that enable science-based entrepreneurship to thrive across borders, building innovation ecosystems and global partnerships.

One prominent example of diplomacy for entrepreneurial science is the European Innovation Council (EIC), which operates under the European Union's Horizon Europe program. The EIC provides funding and support for high-risk, high-impact technologies, offering grants and equity investments that help startups and scale-ups bridge the gap from research to commercialisation. Some examples of EIC-funded projects include AROMA, which develops high-resolution MRI technologies for human brain exploration, or BeeODiversity, which uses artificial intelligence to monitor the activities of wild bees. The facilitation of cross-border collaboration and removal of regulatory barriers for science-based startups allows the EIC to exemplify how diplomatic efforts can directly contribute to the success of entrepreneurial ventures in deep-tech fields such as artificial intelligence, biotechnology, and clean energy. Horizon Europe itself is one of the most ambitious research and innovation programs globally, with a budget of €95.5 billion for 2021-2027 (European Commission, 2021). In addition to fundamental research, it supports innovation and commercialisation, which bridges science and entrepreneurship. Its European Research Council and Marie Skłodowska-Curie Actions initiatives provide significant funding for scientific entrepreneurs, while its European Institute of Innovation and Technology's Knowledge and Innovation Communities (KICs) nurtures partnerships between businesses, research institutions, and policymakers. These are all facilitated by complex diplomatic negotiations between EU Member States and the EU institutions (European Commission, 2019).

Another example is the startup visa programs implemented by countries such as Canada, Denmark, France, and Estonia, which provide streamlined immigration pathways for foreign entrepreneurs in scientific and technological sectors (OECD, 2022). These programs, the result of immigration policy initiatives, demonstrate how diplomatic institutions can implement measures to attract talent,

drive innovation, and strengthen global competitiveness. Multilateral trade agreements also play a role in diplomacy for entrepreneurial science by reducing tariffs on technological goods and ensuring regulatory harmonisation. Agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the EU-US Trade and Technology Council (TTC) have enabled conditions for scientific entrepreneurs to expand their businesses internationally, secure funding, and collaborate with foreign partners with fewer bureaucratic or financial hurdles (Dana, 1990).

Conclusion

Entrepreneurial science diplomacy is an evolving and increasingly critical field at the intersection of innovation, scientific collaboration, and international relations. The examples discussed throughout this article demonstrate that entrepreneurial ventures can serve as powerful instruments of science diplomacy via the potential to facilitate dialogue, address global challenges, and advance international cooperation. Be it through science for diplomacy, science in diplomacy, or diplomacy for science, entrepreneurship provides pathways to bridge national divides while simultaneously driving economic and technological progress.

One of the key takeaways from this exploration is that universities play a fundamental role in fostering entrepreneurial science diplomacy. Institutions such as ETH Zurich and its ETHZ Focus Projects exemplify how academia can catalyse entrepreneurial science diplomacy. A striking example is the Reef Ranger initiative, an ETHZ Focus Project, which combines scientific research and entrepreneurship to facilitate coral reef restoration. This initiative advances marine science, facilitates international collaborations, and contributes to environmental diplomacy and global sustainability efforts.

Moreover, entrepreneurial science diplomacy must be understood within the broader framework of global governance. The São Paulo Framework of Innovation Diplomacy provides a valuable analytical lens for assessing how entrepreneurial science diplomacy operates across different scales and contexts. Initiatives such as the EIC and Horizon Europe illustrate how diplomatic frameworks can be structured to facilitate scientific entrepreneurship. This underscores the necessity of well-coordinated, multilateral efforts. Similarly, startup visa programs highlight the importance of removing policy barriers that limit the mobility of entrepreneurial talent across borders. The systematic integration of science, diplomacy, and entrepreneurship can provide governments and international institutions with a fertile platform for innovation to thrive and serve diplomatic objectives.

Nevertheless, it is important to acknowledge the challenges that come with positioning entrepreneurial ventures as agents of science diplomacy. Science diplomacy often operates under the assumption that scientific collaboration naturally builds goodwill and cooperation, yet geopolitical realities can complicate these interactions. As demonstrated in cases like EcoPeace Middle East or SpaceX's geopolitical entanglements, entrepreneurial science diplomacy does not exist in a vacuum; it must navigate the broader political landscape with pragmatism and strategic foresight. This necessitates a "post-naïve" approach to science diplomacy (Robinson & Olšáková, 2022), one that recognises the complexities of power dynamics while striving for impact-driven cooperation.

Looking to the future, the synergies between entrepreneurship and science diplomacy offer promising opportunities for addressing transnational challenges. Indeed, as international tensions continue to shape global interactions, harnessing the power of entrepreneurial initiatives to build trust and spur collaboration will be more important than ever. Embracing an integrated approach where scientific

innovation, diplomatic strategy, and entrepreneurial action converge, means nations and organisations stand to drive meaningful progress toward a more interconnected and resilient world. The landscape of science diplomacy is rapidly evolving, and entrepreneurship is expected to play an increasingly central component in its future. With that in mind, strategically supporting the potential of science diplomacy-based entrepreneurship offers a way for policymakers, universities, and international organisations to build profitable initiatives that generate global ties and promote sustainable development in a world that needs it more than ever.

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