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Compass Ulysseus

Good practices guide on how incubators, living labs and open classes helps to become ERA Hubs

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Good Practices Guide on How Incubators, Living labs and Open Classes Help to Become ERA Hubs

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Executive Summary

The COMPASS project is devoted to realising the work plan of the European University Alliance Ulysseus, in accordance with ERA policy, to create conditions for the transformation of the Ulysseus ecosystem of innovation hubs into the ERA Hub model. Within the project, we have approached the understanding of the ERA Hub model from the perspective of the most effective way to meet ERA policy priorities and implement relevant measures to achieve the highest possible societal impact.

This report, therefore, focuses on the Ulysseus Alliance's approach to this transformation. It presents the basic ecosystem of the alliance and illustrates good practices of selected measures through individual examples, which are fundamental elements of the ERA Hub model.

The basic concept of the ERA Hub model and its transformation process are built on several fundamental pillars:

- Innovation hubs established in various regions of the Ulysseus alliance, responsible for supporting the development of research and innovation priorities and synergies with the education system. They also serve as connectors within the international environment of the alliance through its organisational structures. Innovation hubs maintain regional independence to address local and regional societal challenges, yet within the context of global challenges and utilising the global synergy of the international research and educational environment of the alliance.

- Development of living lab approaches and environments within innovation hubs as fundamental co-creative approaches for addressing societal challenges based on progressive research and innovation methods.

- Internationalisation of research through international networking and synergy of innovation hubs, living labs, research groups, and centres of significant research of innovation hubs and the entire alliance, utilising capacities, knowledge, and sharing of research infrastructure to rapidly accelerate innovations and increase their impact.

- Integration of education into the R&I environment to provide a multidimensional benefit for transferring the latest knowledge and approaches to solving societal challenges into education and involving students in the R&I environment, as well as continuous support for the education of researchers.

- Internationalisation of research and education to increase synergistic effects.

Although the transformation to the ERA Hub model is continual and very complex, there is expected diversity in ERA Hub readiness level across Ulysseus partners. Some partners are still in the early stages of constituting their Living Labs and organising the main lines of activity of their Innovation Hubs as a crucial starting point of the transformative process leading to the development of an ERA Hub. Other partners with higher but still varied readiness levels within different measures and success stories are serving as good practice facilitators. The transformative process is also fostered by the general innovative environment of the Ulysseus universities (e.g., the Industrial Chairs of USE, active living lab related stakeholders communities or other features which are presented within good practice use cases of the report).

This report presents the synergic good practice within this transformative process on Innovation Hub TUKE example, with its notable development serving as inspiration and role model for the other partners within Ulysseus and beyond. Within related good practices, following success factors were identified, which we consider as cornerstones of the ERA Hub model:

- Development and creation of a vertical R&I living lab environment (focused on R&I domain) with a critical success factor being collaboration with the practice environment and integration of stakeholders into the research and innovation process. Within this integration, communication and presentation of results to the provider of innovative solutions for their clients served very well. Convincing results, but especially visions of future development, not only can convince the provider or seller of innovative solutions and products but also help create a platform with their clients as end-users of innovations, who are drivers of development in their organisational environment and evangelists of these innovations at various professional forums.

- Internationalisation of the research team of a local living lab in the context of using R&I capacities of the Ulysseus ecosystem. In this internationalisation approach, the support of the Innovation Hub plays a significant role as a connector to the international environment and its internal system ensuring the search for suitable international researchers for the local vision holder of the given living lab and the system of support for the research team from the Ulysseus support services such as support for visibility, R&I infrastructure sharing, seed funding, expanding stakeholders, support in obtaining funding and submitting R&I project proposals, etc. In the context of the created environment of the international research team and the internationalisation of the local living lab, however, highly critical approaches such as increasing trust in this environment, for example, through internal NDAs and Code of Conduct mainly for the purposes of access to sensitive data from the local environment and for the rules of creation and use of ideas and R&I results (including commercialisation) are very critical.

- Verticalisation of some living labs in the environment of the international R&I ecosystem such as Ulysseus, where the results of the R&I living lab should be the driving force and innovation factor for the development of the international ecosystem itself. In this report, this verticalisation is demonstrated by the example of the living lab for AI-driven supply chain utilising its knowledge:
    - for the development of R&I sourcing of innovative solutions through progressive ML/LLM to more effectively identify suitable researchers for the internationalisation of local living labs
    - for the development of AI-driven procurement of innovation solutions as a support service for the Ulysseus ecosystem increasing its R&I visibility as well as the transferability of R&I results into the world of practice.
- Integration of education with an international living lab environment and internationalisation of education through the creation of international student teams for integrating education and innovative approaches to solving societal challenges with the involvement of stakeholders in evaluating the results. Such integration results not only in increasing skills but also in developing innovative abilities of students for practice and creating interesting solutions with the potential to establish a startup company.
- Support for startups and innovation centre in the commercialisation of living lab results and international research and student teams leading to effective development of the startup environment and transfer of knowledge into practice with high impact.

Within the individual good practices and relevant measures, this report provides inspiration and knowledge that can help effectively develop the integration of ERA Hub features and activities into environments with low but also higher levels of readiness of European universities, their alliances, and other innovative ecosystems.

Introduction

This guide serves as a roadmap for innovation hubs, living labs, and higher education institutions (HEIs) seeking to transform into ERA Hubs, in line with European Research Area (ERA) priorities. The strategies and recommendations provided here are based on best practices and lessons learned from various initiatives, esp. Ulysseus Alliance, to inspire similar transformations across different contexts.

The COMPASS project, funded by Horizon 2020 within the Science with and for Society (SwafS) program, aimed to develop an institutional transformation model for research and innovation in line with ERA priorities. While this guide draws on the experiences and strategies developed by the Ulysseus Alliance, it is designed to be a resource for a wide range of institutions aiming to build synergies between research, innovation, and education at local and regional levels. The good practices and action plans presented here are intended to support universities, researchers, and R&I ecosystems in driving systemic, structural, and sustainable impact across Europe.

The project has supported the development of strategies and concrete action plans in order to position **Ulysseus as an institutional transformation model at research and innovation level**. It has **provided good practices** to institutions inside and outside the alliance, leading the Ulysseus European University in a transforming process to boost interlinked research, innovation and education with high impact in local and regional development, thus, contributing to the economic, social and cultural growth of Europe. The project has enabled Ulysseus to **reinforce their joint long-term vision for research and innovation to drive systemic, structural and sustainable impact at all levels** of the institutions involved.

About the Guide and How to Use It

This guide has been developed to maximize the tools for sharing research facilities and resources, including the transformation of innovation hubs into ERA Hubs. As innovative joint structures at the European level, Innovation Hubs (IHs) can serve as models for building higher education-supported innovation ecosystems. Throughout the guide, the Ulysseus Alliance's journey toward ERA Hub accreditation is used as an example to illustrate key concepts and strategies. However, the principles outlined here are applicable to a variety of contexts and can be adapted to the specific needs of other institutions.

The guide serves as a roadmap for other European Universities, researchers, R&I ecosystems and HEI community leaders seeking to improve and build synergy between R&I, education and societal impact. Based on good practices, case studies and structures developed within Ulysseus ecosystem, it offers **inspirations and practical insights and tools with potential to transform R&I and HEI into synergistic ERA Hub**

model.

How to use this guide:

1. The core concept involves understanding how an international structure, such as the ERA Hub, can effectively contribute to fulfilling the priorities of the ERA policy. The main priorities identified as crucial for recognizing an ERA Hub are explained in Step 1.
2. Based on these priorities, we outline the various aspects and steps of the ERA Hub concept that are suitable for implementation. As a starting point, we explain the core steps for creating an international HEI and innovation partnership with a basic governance model in Steps 2.1 to 2.4. Examples and inspirations are drawn from the Ulysseus Alliance and its related governance model, as detailed in Annex 2. Recommendations based on the core ERA Hub concept as demonstrated by the Ulysseus Alliance are discussed in Steps 3.1 to 4.6.
3. For these steps and aspects, we also present concrete examples of best practices from our experiences, which are included in the appendices. These examples provide more detailed insights into several aspects of the applied measures and are intended to serve as inspiration.
4. A specific and comprehensive example is provided in Annex 1, illustrating the ERA Hub Transformation Strategy Implementation at the Innovation Hub of the Technical University of Košice (Slovakia). This use case covers many detailed aspects of the ERA Hub transformation initiative and explains several steps from the core guide in greater detail. We encourage readers to review this example in the context of the ERA Hub core concept to understand the concrete actions and lessons learned related to this new approach for integrating R&I and HEIs to achieve a higher societal impact.
5. The ERA Hub concept is an open, continuously developing model that should incorporate best practices from other alliances and partnerships. We welcome discussions on this model with all stakeholders and look forward to collaborating for a better future for HEI, R&I, and society.

Transformation to an ERA Hub model

ERA policy alignment

Step 1: Define and understand priorities based on ERA Policy as a Basis for ERA Hubs transformation

The European Research Area (ERA) is an initiative launched by the European Union to create a unified and competitive research area within Europe. It aims to enhance collaboration and cooperation among European countries, promote excellence in research and innovation, and address common challenges through joint efforts. The ERA policy has set several priorities to achieve its objectives. These priorities include promoting open science and open access to publications and data, strengthening research infrastructures, fostering innovation and knowledge transfer, attracting and retaining top research talent, and increasing the accessibility and effectiveness of funding programs.

The main driving factors behind the ERA policy are the **recognition of the importance of research and innovation** in driving economic growth**, job creation**, and **societal development**. Additionally, the ERA policy also acknowledges the **need to leverage Europe's existing assets and strengths in R&I** with support of breakthrough AI development, talent, and industry. One of the key initiatives in this regard is the establishment of an ERA Hubs.

The **ERA Hub is a transnational platform or R&I and HEI ecosystem that aims to foster collaboration, exchange of knowledge, and coordination among stakeholders involved in research and innovation activities within the European Research Area to bring higher societal impact**.

This hub should serve as a central point for connecting students, researchers, innovators, policymakers, and funding agencies across Europe. It will play a crucial role in facilitating the sharing of best practices, promoting cross-border collaborations, and streamlining research and innovation processes to face efficiently societal challenges.

Based on ERA policy-related documents and communications, we have set up several objectives and key features:

1) **European Research Infrastructures development and sharing** and support its state-of-the-art incl. integration, cooperation, sharing and enhancement of existing European Research Infrastructures and utilizing benefits from sharing

R&I infrastructures between researchers, research and innovation communities and ecosystems including stakeholders from the world of practice.

2) **Support for funding, reforms and increase of EU R&D public and private investment,** where the crucial points are improving national resources/funding and programmes regarding rising investments in RDI and in line with joint priorities and goals, coordination and pooling of resources in joint research programmes, improving the collaboration between private and public R&I in the Member States and R&I intensive regions, and improving access to finance.

3) **To support researcher mobility and career development** by delivering information and support services to professional researchers as supporting skills and talent development.

4) **Open Science** and open education development through enhanced access to open, free of charge, re-usable scientific information through the Open Science initiative and Open Education. Open Science focuses on making scientific research, data, and processes openly accessible, while Open Education aims to provide broader access to educational materials and resources through online platforms. These concepts are interconnected as they promote transparency, collaboration, and wider dissemination of knowledge and resources across Europe and beyond, aligning with ERA's goals of fostering innovation and cooperation in research and education.

5) **Reduction of RDI discrepancies** within the ERA ecosystem and between European regions with emphasis on Widening countries, in view of increased participation of Widening countries in FPx, increased Science quality, joint innovation activities and d. mobilisation of research and technological capacities in less developed regions.

6) **Translating R&I results into the economy and society** as the main impact factor for sustainable growth and global competitiveness through R&I efficiency and productivity growth (through improved fitting with current and future needs and societal problems), strengthening industrial innovation and bringing science closer to citizens.

7) **Science quality improvement**, incl. international scientific collaboration intensification through Increasing the number of high-quality scientific publications, better incentivising high-quality researchers and innovators to work together and become a pole of attraction for the world's best talents as well as joint international innovation actions.

8) **Gender equality, ethics and inclusiveness in R&I** through equal opportunities in R&I for all marginalized or risk communities and promoting ethical and

responsible R&I.

9) **Empowering HEIs to develop in line with the ERA** and in synergy with the EEA where universities working together across borders, through transnational cooperation in education & R&I.

10) **Effective governance** through developing an innovative ERA Hub governance model in the context of developing R&I ecosystems within the ERA policy. Effective governance entails ensuring coordination, transparency, and accountability among various stakeholders in R&I, facilitating strategic planning and evaluation, promoting innovation and technology transfer, and securing financial support and investments for research and innovation initiatives. It plays a crucial role in fostering innovation and competitiveness within R&I ecosystems.

Transformation to an ERA Hub model:
Building an ecosystem with global governance model

Step 2.1: Establish academic partnership and define challenges

In this step, the focus is on forming strong academic partnerships and defining the core challenges the alliance will address. Start by identifying universities or research institutions with complementary strengths and priorities. Ensure that each partner brings unique value, whether it is strong research capabilities, innovation potential, or geographical reach. Diverse academic institutions from different regions and fields as well as R&I readiness level can come together to form a complementary and versatile ecosystem with great impact and inspiratory ideas for everyone. Integrate universities with different strengths—from comprehensive research institutions to specialized technical and applied sciences universities. This diversity allows for an agile and dynamic collaboration. The Ulysseus model shows that different types of universities (e.g., research-based, technical, and applied or social and humanities sciences) can create synergies that make the ecosystem more robust and capable of addressing multidisciplinary challenges complementing each other's strengths. The clear focus on defining challenges early on ensures that the partnership is purpose-driven from the start.

The alliance does not need to be based solely on EU grant funding, such as the European Universities Initiative, but can also include partnerships with non-EU regions. These partnerships may involve stronger partners for transferring knowledge and successful practices, as well as less developed regions where the goal is to support their growth. This synergy not only fosters knowledge sharing but also enhances global societal impact and promotes human values and social responsibility.

Step 2.2: Define global governance model and organizational structure

Defining the global governance model is crucial to create an organizational structure that incorporates innovation hubs, each with its own **governance framework**. Each innovation hub should align its challenges with both regional priorities and broader global objectives, such as the UN SDGs, European Green Deal, and Horizon Europe. This ensures that the work of the hubs contributes to local development while maintaining a global impact. For example, Ulysseus innovation hubs have tailored their challenges—such as robotics, sustainable entrepreneurship,

and cybersecurity—based on regional needs while addressing international R&D priorities. The governance model should ensure flexibility, allowing each hub to adapt to local conditions while maintaining strategic alignment across the alliance.

In creating the governance model, it is important to establish both strategic and operational levels, with clear roles and responsibilities at each. The Ulysseus model demonstrates that having **a central management office** ensuring strategical alignment and monitoring of progress, along with **distributed leadership across the hubs**, helps ensure coordinated efforts while allowing autonomy in decision-making. Lessons learned from Ulysseus hubs highlight the importance of fostering collaboration not only between hubs but also with local stakeholders, such as regional governments, businesses, and NGOs. This **multi-stakeholder approach** strengthens the innovation ecosystem and ensures that each hub can function effectively within its regional context while contributing to the overall goals of the alliance.

Step 2.3: Create local/regional innovation hubs with local organizational structure

Developing human capacities is essential for ensuring that each innovation hub operates effectively within its governance model. Each hub must recruit and train a capable team to manage daily operations and communicate with the central management level. This ensures alignment with the strategic goals of the alliance while maintaining flexibility at the local level. It is equally important to build strong partnerships with local stakeholders such as regional governments, industry leaders, and research institutions to secure support and ensure that the hub's activities address both local needs and global challenges. These partnerships enhance the collaborative nature of the hub, ensuring that breakthroughs are achieved through diverse contributions.

The **goals and responsibilities** of the innovation hub include serving as a focal point for European innovation by uniting researchers, educators, entrepreneurs, and data scientists to foster collaboration and accelerate breakthroughs in their local thematic areas with potential global impact. More concretely, the hub should be integrated with living labs environment, a collaborative space for testing and prototyping innovative ideas supporting them in R&I internationalization and cooperation, stakeholder community enhancement or specific local support action related to local or regional specifics and needs. Additionally, hubs should facilitate continuous skill development through learning lab development incl. common R&I results awareness through integration with local or international educational environment and its innovative and open educational activities, offer joint European diplomas, and support start-up growth through dedicated incubation programs. It

is desirable to understand, that these support is not only for local researchers and other local nodes but also for students, innovators, practitioners from international environment. Furthermore, hub should integrate a semi-shared Data Warehouse to support the global digital platform of the ecosystem, ensuring that data-driven insights are accessible across borders and the synergy with shared research infrastructure development. The local management level must include clear communication structures with the strategic management level and among local hubs, ensuring cohesion in organizational strategy and responsibilities.

To ensure **effective local-to-central governance**, it is recommended that each hub appoints an Innovation Hub Manager (IHM) and a Chief Strategy Officer (CSO), supported by a steering committee. IHM and CSO ensures coordination activities and communication with central management level, partners, and with local nodes incl. academic environment, incubators and start-up centers and other. The steering committee should be composed of local hub members, representatives from partner hubs, and key international and local stakeholders. The steering committee's role is to foster collaboration within the international ecosystem and with external stakeholders. It is crucial to ensure a balance of complementary skills and goals among committee members—for example, an innovation hub focused on digital transformation can benefit greatly from expertise in green technologies, social responsibility, artificial intelligence, and social sciences. This complementarity enhances collaboration and increases the hub's overall societal impact.

Step 2.4: Support knowledge sharing between hubs and accept their specificities or diversities

Effective knowledge sharing among innovation hubs requires acknowledging and embracing the unique characteristics of each hub, which arise from their regional, academic, and organizational contexts. Hubs should actively foster communication and collaboration to share best practices, insights, and lessons learned across defined international ecosystem, continually refining governance, management practices, and support services for local and external partners.

Innovation hubs must create sharing knowledge environments that encourage the regular exchange of localized solutions, allowing these to be accepted on a broader, global scale. Structured activities such as regular meetings of innovation hub representatives play a vital role in this process. To support sustainable governance, horizontal training programs, including open educational formats and tailored leadership training, should be introduced. These programs will enhance governance and innovation capacities, ensuring that leadership skills evolve to meet both local and international ecosystem needs.

Simultaneously, it is essential to create structured mechanisms that promote knowledge-sharing and collaboration across the entire ecosystem facilitated by

innovation hub. Coordination through global digital platforms or networking application like Ulysseus Matching4Coop application[1], can enable the exchange of ideas, services, and products, fostering cross-border cooperation on joint projects. Furthermore, adopting advanced networking tools powered by AI/LLM technologies will make it easier to identify potential collaborators and promote innovation uptake, thus enhancing R&I networking (e.g. R&I networking and sourcing tool explained in Annex 1).

While applying general governance standards improves global alignment, it is equally important to accommodate flexibility at the local level. Allowing partial autonomy for managing local structures, such as living labs, ensures the stimulation of sustainable, local good practices, which can then be shared globally.

[1] https://ulysseus.eu/sk/match4cooperation/

Transformation to an ERA Hub model:
Building a Synergetic Approach

Building a synergistic approach to establish or understand the ERA Hub model requires a comprehensive understanding of the complexity of the European Research Area (ERA) priorities in order to contribute to the individual pillars and goals of ERA policy. The fundamental principle lies in fostering internationalization within the established ecosystem of innovation hubs and beyond, implementing innovative models across various relevant ERA policy areas, and deploying efficient measures and supporting activities to contribute to ERA policy objectives.

In line with this, we are building the Ulysseus ERA Hub model through a synergistic approach based on the internationalization of an integrated Science, Research & Innovation environment, with higher education institutions (HEIs) collaborating intensively with the community of stakeholders to achieve greater societal impact.

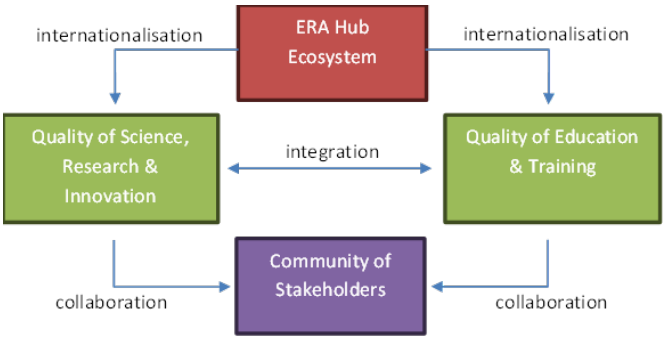

Figure 1 Core interconnected pillars of ERA Hub

This core principle should be established around joint efforts to adopt ERA priorities and measures, ensuring a diversity of innovative approaches developed in local environments, while maintaining synergy with global goals and missions.

When considering the adoption of the ERA Hub principle, aligning innovation hubs and the entire innovation and HEI ecosystem with ERA policy is crucial. This initiative involves several steps to assess the readiness level of your ecosystem and identify the gaps that need to be addressed.

Step 3.1: *Aligning Innovation Hubs with ERA policy* - Map crucial ERA policy priorities to existing practices

The first step is to assess the current state of innovation hubs and relevant universities within the international partnership, with a focus on understanding which existing good practices in local environments of hubs and universities align with certain ERA policy priorities and can be effectively shared and transferred to other hubs or into the global ecosystem. In this context, we recommend setting up a matrix of ERA priorities, to which specific measures, practices, and solutions are mapped based on a survey conducted among partners.

It is important to ensure a sufficient common understanding of the presented ERA policy priorities through workshops and creative meetings with representatives of the innovation hubs, where the individual priorities and preliminary practices can be discussed. This is crucial for ensuring a sufficient level of knowledge and understanding among innovation hub representatives, who will subsequently communicate with the internal environment of the hub and university.

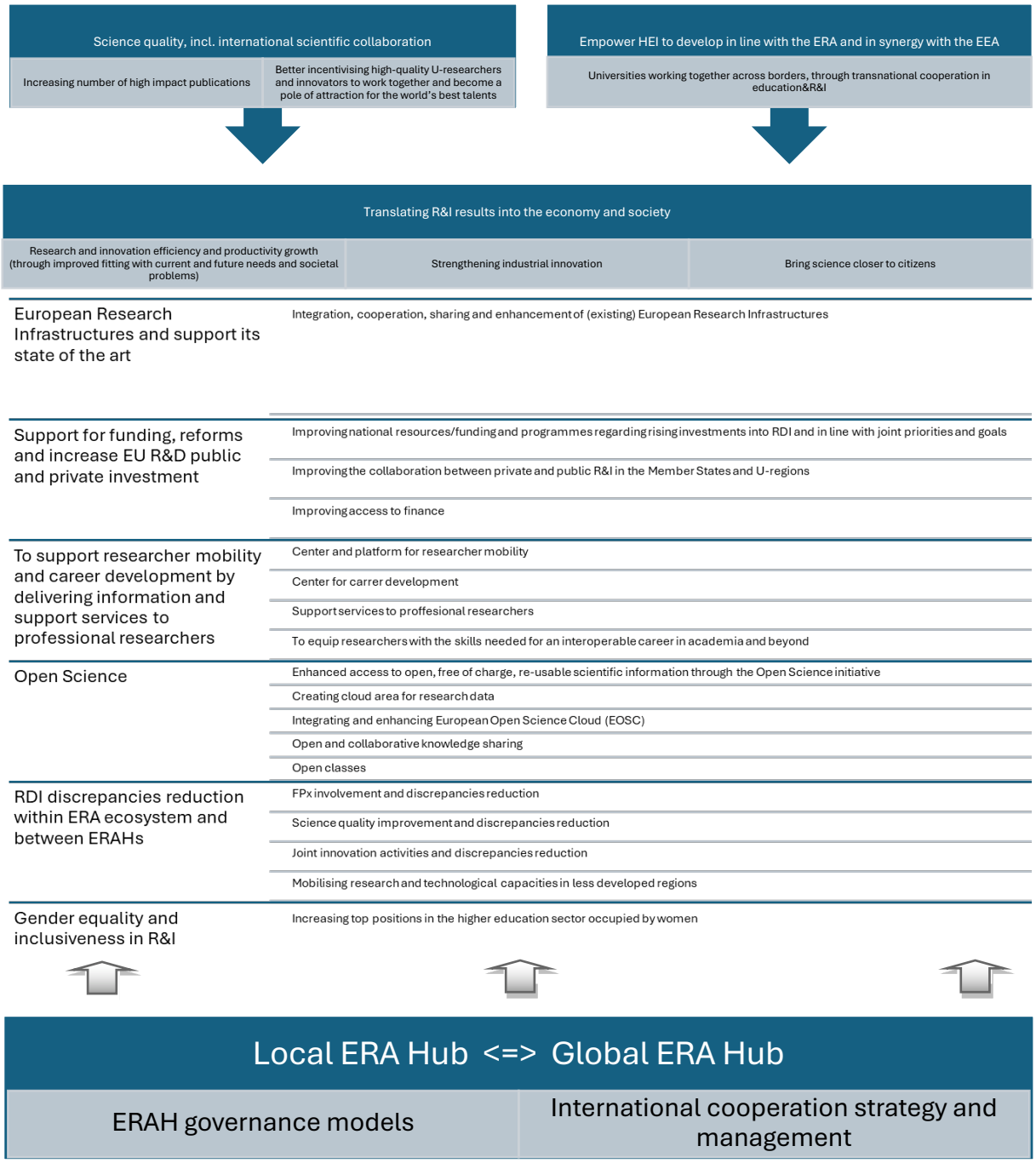

Figure 2 ERA Hub model of Ulysseus with ERA elements

In this process, an effective form of communication between the innovation hub and its internal/local environment must already be in place, which should reduce spam, prevent overloading, and ensure commitment and interest from various departments, including the management level.

On the Fig. 2 we are providing an approach of ERA elements identification which can be used to develop an assessment matrix for each IH.

Step 3.2 Identify gaps and propose strategies and find funding

In this step, innovation hubs need to leverage the results of the previously conducted survey on existing practices that fulfil ERA priorities. A crucial aspect is recognizing that disparities exist among different hubs and universities in how these priorities are addressed. However, while acknowledging disparities and gaps in practices significantly contributing to ERA priorities, it is equally important to identify and address the gaps where improvement is needed. Each hub should aim to converge towards the full realization of ERA elements and priorities in its own unique way, utilizing their local potential, capacities and future plans and propose solutions tailored to both local and global contexts. Addressing these gaps often requires a strategic, collaborative approach, where solutions can be implemented through joint efforts within the alliance or in a defined consortium, esp. by submitting project proposals targeting relevant funding opportunities, such as Horizon Europe calls or other EU and national funding schemes. Submitting these proposals as an alliance or with a well-defined partner consortium not only strengthens the likelihood of success but also supports convergence by reducing disparities and also fosters the development of innovative solutions that can be integrated into the global ERA Hub ecosystem. On the other hand, sharing existing local initiatives, solutions, or future plans of local Innovation Hubs can serve as a pool of inspiration and provide partial solutions. This requires securing local commitment and engagement from all stakeholders, including university management, to ensure that proposed strategies and alignment are effectively communicated, promoted, and implemented. Our experience shows that the internal environment of each hub holds significant potential to offer existing or partial solutions. However, the main challenge remains engaging all researchers and staff from large university environments in international partnership initiatives such as Ulysseus.

An example of this approach can be seen in the Ulysseus alliance's earlier efforts to converge different innovation hubs' practices in internationalization. While hubs varied significantly in their initial readiness, the alliance identified gaps and developed joint project proposals focused on enhancing research infrastructure and innovation processes within several mainly Erasmus projects. Through these collaborative efforts, they successfully secured funding for several initiatives that not only addressed local gaps but also contributed to the wider ERA Hub ecosystem by fostering

international collaboration and enhancing the global impact of each hub.

This fundamental principle in line with knowledge sharing of local best practices has significant spillover effects towards reducing disparities between countries, partners, and their regions.

In next figure we are presenting multidimensional synergistic effects of knowledge sharing among local innovation hubs and environments highlighted by a new model of connecting individual elements and measures of the ERA Hub in the context of ERA policy.

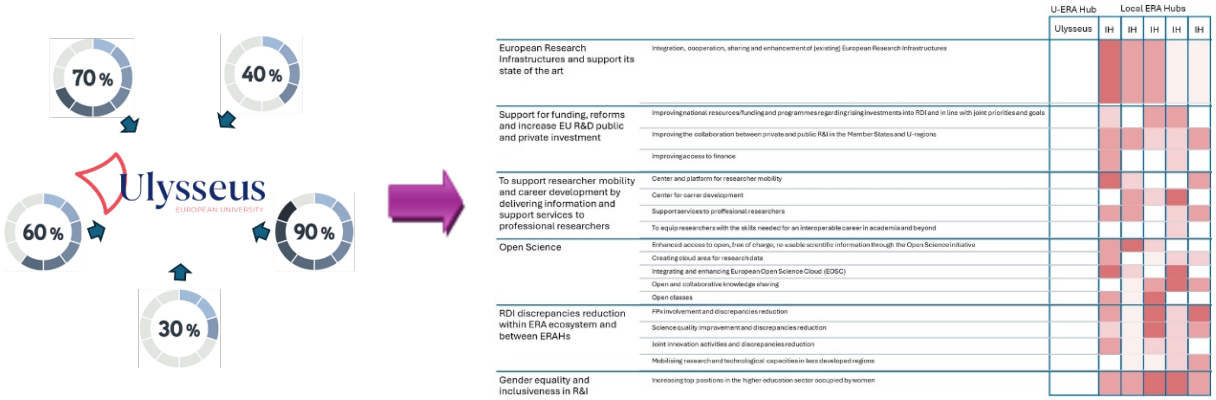

Figure 3 Shared knowledge, best practices, R&I service infrastructure, and models to high-quality convergence & discrepancies reduction.

It must be understood that the ERA Hub should be a living environment continuously enhanced, improved, and adapted to the current needs with a multispectral win-win approach.

Transformation to an ERA Hub model:
Living Labs integration as Cornerstones of ERA Hub

The motivation for enhancing ERA policy arises from the complex, multidimensional, and interconnected challenges facing society. Traditional research and development approaches often fall short in addressing these issues effectively. In response, the European Union, along with other players and ecosystems, has recognized the concept of living labs as an innovative approach to research and development.

Step 4.1 Integrate Existing Living Labs as Cornerstones of ERA Hub

Living labs provide a real-world environment for the creation, testing, and deployment of innovative solutions and technologies, enabling a more holistic and practical approach to problem-solving. By involving end-users, stakeholders, and researchers in the co-creation process, living labs uniquely position themselves to understand the real needs and behaviours of the target population.

Several studies highlight that a key success factor of living labs is their ability to balance open and private innovation, fostering collaboration among diverse stakeholders and interdisciplinary researchers. This approach not only improves the quality and relevance of solutions but also promotes knowledge sharing and co-learning. To ensure that living labs have a significant societal impact, it is essential to critically assess their ethical, legal, and social implications, ensuring responsible and inclusive innovation. By doing so, living labs can become powerful platforms for positive change and help shape a more sustainable and resilient future within ecosystems like Ulysseus, through stronger connections, shared ethics, and inclusive practices.

For the main success factors for living lab efficiency and success we recommend to study materials by The European Network of Living Labs (ENoLL), which provides also certification of living lab and the membership in European network of Living labs.

In this step, identifying existing research laboratories that at least partially meet living lab concepts is beneficial as a starting point. Many laboratories are at different levels of readiness (according to official ENoLL requirements) and vary in terms of innovation or potential impact. The local Innovation Hub should engage with relevant researchers within the university to identify laboratories that meet a sufficient level of readiness. This level may vary for each innovation hub and its local environment, depending on the number of laboratories, their potential to address local or global needs, and other factors that should be determined by the Innovation Hub.

Various methods can be employed, ranging from passive promotional materials to active outreach within the university. A critical success factor is to ensure that these discussions provide the necessary information to motivate LL' stakeholders and find mutually beneficial solutions. Sharing expectations and best practices from living lab representatives within the Innovation Hub during these discussions can help overcome initial trust barriers and create opportunities for the exchange of best practices between the Innovation Hub and living labs, as well as among the living labs themselves.

Step 4.2 Define IH's support services for Living Labs

Define clearly support services provided by IH and international ecosystem which should support living labs with:

Internationalisation of research groups where IHs should facilitate connections with international researchers and support the creation of international research teams by providing networking special SW tools, seed funding, and access to global research infrastructure.

Enhancement of community of stakeholders - actively engage local and international stakeholders by organizing collaborative workshops, creating advisory boards, and promoting stakeholder-driven research initiatives that align with local and global needs. Local IH has the capacity to identify suitable stakeholders also from other IHs or from stakeholder community established around alliance/international ecosystem.

Data management support The importance of balancing private and open knowledge and innovation is underscored by the rapid growth of open data and the communities it spawns, where the enrichment of sensitive data can significantly add value to innovative solutions and impact. Innovation hub should provide help with data management services and legal support to overcome barriers of sensitive private data sharing for international research as well as educational purposes.

Access to Research infrastructure from local and international environment, where research groups can showcase their work and exchange best practices, share research data with other hubs, fostering co-learning and global synergy.

Incubation Programme dedicated for research-driven start-ups generated from LLs, offering mentorship, prototyping support, and funding opportunities to turn research outcomes into market-ready innovations.

Global Visibility and Promotion should be provided within international ecosystem of the partnership or alliance research groups and living labs on international platforms, conferences, and digital networks to increase visibility and attract collaborations and funding.

Career Development and Research Mobility by organizing international mobility schemes and providing access to international career-building opportunities. These can include collaborative PhD programs, researcher exchanges, and internships across partner institutions.

Step 4.3 Identify the Horizontal Potential of Living Labs for the Entire Ecosystem

A key recommendation for maximizing the impact of living labs is the integration of both horizontal and vertical aspects of research and innovation. In the ERA Hub ecosystem, while the focus is often on domain-specific challenges aimed at addressing societal needs or external practical problems, it is equally important to harness the research and innovation capacities for the internal development of the ERA Hub ecosystem itself.

To ensure synergistic effectiveness and sustainable growth, innovation hubs must prioritize living labs with horizontal R&I measures as a core feature of the ERA Hub model sustainable development. This involves leveraging research groups within living labs not only for solving external challenges but also for fostering internal innovation and growth within higher education institutions (HEIs) and the international innovation ecosystem of the alliance.

Based on our experience, key research and innovation efforts can focus on fostering internal R&I networking through the development of new AI-driven networking tools among research groups. The aim is to increase the visibility of R&I results, enhance international cooperation, and improve the translation of these results into society. This focus is typical for living labs managing AI/LLM or supply chain management research but can also be applied to other R&I domains.

A specific horizontal scheme can be offered by an innovation hub or learning lab as an educational program for internal stakeholders across the entire ecosystem. R&I activities, as well as researchers, should be closely integrated into open classes, Collaborative Online International Learning (COIL) programs, joint degree initiatives, and career development opportunities to continuously improve the necessary and relevant skills.

By embedding a strong horizontal R&I focus, living labs can not only contribute to external societal challenges but also drive innovation and excellence within the HEI and the broader international alliance ecosystem.

Step 4.4 Identify Vision Holders and Research Groups Around Potential Living Labs and Provide Internationalisation Support from Local Innovation Hubs (IHs)

To successfully build and internationalize living labs, it's essential to identify vision holders and research groups that are committed to developing research and innovation (R&I) with a global reach. The process, as demonstrated in the TUKE use case, involves structured support from Innovation Hubs (IHs) at each stage. The Innovation Hub is responsible for disseminating a call for interest within the internal environment of the university to identify vision holders interested in establishing an international research team around their research, ideally centered on their living lab. Vision holders should clearly define their goals and ambitions for establishing a living lab during IH meetings that involve the steering committee and representatives from partner institutions.

A critical task of the Innovation Hub is to help vision holders and research groups find the right collaborators, both locally and internationally. This can be achieved through a combination of active support from IH representatives, who assist in finding suitable researchers from partner institutions. This approach has the key advantage of ensuring trust in these connections, as introductions are made by a recognized and trusted individual from the local IH who is familiar to staff at partner universities. To identify all potential research groups from partner environments, AI/LLM-driven tools and platforms are highly effective for matching researchers and teams based on their previous publications or project deliverables. Additionally, local databases of researchers can provide further information about researchers with complementary expertise or those interested in exploring new research fields. A good practice is that such databases are built on a voluntary basis by each partner through online structured questionnaires.

Once research groups are identified, it is crucial to conduct kick-off meetings led by vision holder to set expectations and clearly define roles within the research teams. Innovation Hubs play a pivotal role in facilitating these meetings, ensuring that all team members understand their responsibilities and how the project aligns with both the ERA Hub's or Alliance's objectives and the vision holder's goals. It is recommended to provide templates and guidance for structuring research agendas and monitoring milestones. Innovation Hubs must take an active role in monitoring research groups by implementing regular check-ins and progress monitoring frameworks to ensure that the research teams stay on track toward their objectives. It is also recommended to apply Key Performance Indicators (KPIs) that align with both the global goals of the alliance and the specific outcomes defined by the vision holder.

One of the supportive roles of the Innovation Hub is to provide mentorship and assistance to research groups, helping them navigate challenges such as funding, stakeholder engagement, or technical hurdles. A key service of the Innovation Hub is to support research teams in securing funding for their projects involving assisting in preparing and submitting proposals; offering proposal writing support or facilitating the creation of consortia that bring together relevant stakeholders, which can increase the chances of project success.

Step 4.5 Integrate Existing Living Labs and Research Groups with Local and International Educational Environments

Integrating living labs with both local and international educational environments is a vital component of the ERA Hub model. This integration ensures that students and researchers benefit from hands-on learning experiences while contributing to real-world challenges. The key to success lies in fostering strong connections between living labs and educational institutions, leveraging innovative learning methods, and providing international opportunities for researchers and students alike.

One of the most effective ways to **integrate living labs** with the educational environment is to embed them **directly into academic curricula**. This allows students to engage with living lab projects as part of their coursework or thesis, giving them practical experience in research and innovation. Encouraging universities to align their academic programs with ongoing projects in living labs can bring spill-over effects for both sides, students are facing real world problems with progressive and often creative solutions for researchers or stakeholders. This can be enriched by providing incubation programmes for students by local Innovation hub. Together, integrating students from various disciplines can contribute to multidisciplinary and out of the box problem-solving, gaining essential skills in innovation and research methodologies. Therefore this integration provides a bridge between academic theory and applied research. Together, lessons learned from pilot activities show that involving students in living lab projects not only enriched their educational experience but also contributed valuable insights to the research itself and raise interest to continue on PhD studies.

Internationalization of R&I driven Education is a key component of enhancing the educational and research value of integrated living labs. Through partnerships with other universities and research institutions, students and researchers gain access to broader network of expertise, tools, and resources and facilitate to create international, multicultural, multidisciplinary students' teams. To increase success, alignment of local studies or courses has to be discussed with lecturers and supervisors of study programmes which is facilitated by IH. Supported research groups and LLs by IHs can efficiently integrate and tune joint learning actions for students defining

goals, problems but also stakeholders as potential testers or end users of students' solutions. Synergic activities around this step are establishing exchange programs, joint degree programs, and collaborative projects within international partners. The use of Collaborative Online International Learning (COIL) programs allows students and researchers to work on projects with their international peers remotely.

Innovation-driven education is another key element of integrating R&I and living labs into the educational environment. Student teams participating in living lab activities and solving real-world problems can transform their results into start-ups with support from the incubation programs of local Innovation Hubs. This not only facilitates the translation of R&I results into practical applications but also stimulates the interest of other students, inspired by the success of their peers.

Leveraging **open education resources and online learning platforms** ensures wider access to education and research collaboration. Living labs can use these platforms to involve students and researchers in a more flexible and scalable way promoting the use of **open classes** and **MOOCs (Massive Open Online Courses)** and to integrate more students and researchers into living lab environments. Open education initiatives allow the broader academic and research community to access cutting-edge research, participate in collaborative projects, and contribute to innovation. The success of open education activities in the Ulysseus initiative was driven by inclusive access to free learning resources and platforms like COIL, which enabled international collaboration without the need for travel. Furthermore, the practical application of research to real-world challenges, involvement of industry and community stakeholders, flexible and scalable online platforms, and the encouragement of interdisciplinary learning all contribute to the significant impact and broad participation in these educational programs.

Researcher and Student Mobility Programs are specific and crucial measure for fostering international collaboration and skill development. Mobility programs give students and researchers the opportunity to work in living labs across different countries, gaining exposure to diverse research cultures and methodologies. Structured **mobility programs** enable students and researchers to spend time in living labs abroad, supported by funding and mentoring schemes. This can be efficiently facilitated through existing Erasmus+ programs or by establishing dedicated research mobility grants.

By integrating living labs with local and international educational environments, universities and research institutions can create a dynamic learning ecosystem that drives innovation while developing the skills of future researchers and innovators.

Step 4.6 Develop Efficient Strategies for Increasing the Visibility and Usability of R&I Results and Researchers

Today, the use of digital technologies such as artificial intelligence, the Internet of Things, and big data analytics is becoming increasingly prevalent in living lab approaches, not only to enhance efficiency in innovation development but also to foster collaboration, knowledge sharing, and integration into the global innovation or ERA space. Some of these technologies, particularly new LLM models, have immense potential for creating breakthrough applications that increase the visibility of research results, researchers, and the entire research-innovation ecosystem. The application of these technologies to data from scientific journal articles, project reports, and start-up centers opens up new opportunities for services that map relevant research results to practical problem-solving, as well as innovative solutions for public administration, taking into account their strategic goals and specific needs.

Moreover, discussions with industrial players and procurement unit representatives highlight a significant need for rapid prototyping and iteration, enabling the quick deployment, adaptation, or improvement of solutions based on real-time feedback. A specific form of rapid innovation is operational procurement of innovation, where certain types of innovations at higher TRL levels can be easily adopted through standard procurement or sourcing processes and related decision-making. In this context, digital technologies and AI can enhance the visibility, potential, and awareness of R&I outcomes for procurement managers or research lab members within industrial or public organizations. The horizontal living labs identified in previous steps, which have the potential to provide innovative solutions, should act as facilitators of this transformative change, translating R&I results into practical applications.

An inspirational experience is presented later in the chapter, R&I Sourcing Tool for the Ulysseus Ecosystem as a Core ERA Hub Feature.

On the base of presented recommendations, Ulysseus are developing new concept of distributed living lab ecosystem as Ulysseus ERA Hub model integrating this living lab ecosystem also into several other dimensions to fully utilise its potential to fulfil ERA priorities and objectives.

We are presenting our concept of systemic and synergetic living lab approach as cornerstone of ERA Hub model with higher ERA impact.

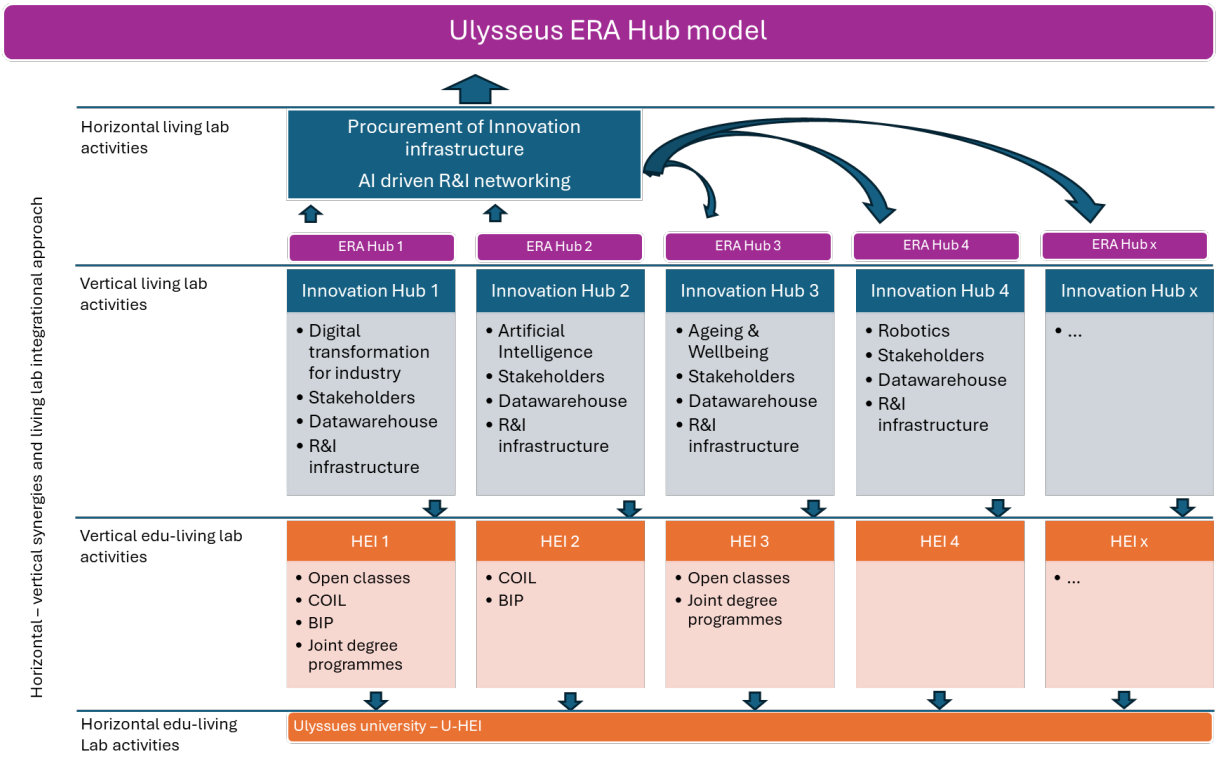

Figure 4 Distributed but synergic framework of Ulysseus ERA Hub based on horizontal and vertical sub-models

Benefits of Transformation Approach of a Living Lab into the Local and Global ERA Hub Model

Benefits for Local Living Lab Innovation Processes

- **Better support in obtaining funding** through 1) the use of mentoring schemes and services of joint project departments within the international alliance, integrated and continuously developed infrastructure services (for supporting procurement of innovations by industry and the public sector) and through 2) building their own platforms (or ERA Hub platforms) at a higher level in cooperation with authorities on various government level for the reform of R&I and educational programmes and ensuring their synergy (in terms of the significance of the living lab ecosystem and the use of its innovative potential to address societal needs defined in R&I programmes).

- **Expansion and utilisation of shared infrastructure**: by 1) external environments of other local hubs of the alliance as well as the alliance's own continuously and needs-based developed global infrastructure and by 2) expanding the local ERA Hub (by enriching its infrastructure of services and data environments with international activities of researchers within and outside the Ulysseus environment, or activities of the innovation process during co-creation and co-design activities with the community of stakeholders or other Ulysseus environment partners).

- **Improvement in the quality of researchers and innovators** in the living Lab: through 1) engagement in solving real problems in an interdisciplinary and international research environment and by integration of supportive educational services for researchers provided by local and Ulysseus IHs within various HEI or open class schemes and 2) real feedback on the results of deployed innovations in practice.

- **Increasing the impact of the R&I process and results** by a higher number of startups within the living lab, mentoring start-up schemes provided by local or other innovation hubs within the Ulysseus ecosystem, utilization of international hackathon schemes, support for physical spaces and infrastructure of the relevant startup center of the local IH and by implementation of service infrastructure for procurement of innovation for identifying the needs of industry and the public sector and feedback from testing and deployment of

innovations in a real environment.

- **Improvement of sustainability**: through 1) integration of innovations and knowledge into practice and positive feedback, 2) integrated automated evaluation of living lab results and their impact and improving reputation and trust, 3) integration into education and preparing students for innovative challenges and 4) shaping students' mindset based on integrated educational activities about the domain, research, and innovative problems and results of the living lab for better recognition of living lab in the real world.

Benefits for HEI Environment

The HEI environment benefits from integration with the international ERA Hub environment thanks to:

- Integration of the most up-to-date R&I results from international living lab environments into student education.
- Development of skills and inclusion of students in solving real needs and problems in an international student and educational team.
- Development of student profiling and reputation based on their solutions and evaluations by the stakeholder community of the local IH.
- Enhancing the quality of teachers and researchers by supporting their education through local and Ulysseus training courses, mobility/traineeships/visits of teachers/researchers/students.
- Increasing the employability of students in innovation-intensive areas.
- Close connection with the R&I environment and simple and effective modification of study syllabi and programs based on changing needs and R&I trends.
- Understanding of multidisciplinary approaches to problem-solving and understanding of intercultural specifics.

Benefits for the Global Ulysseus ERA Hub

The global Ulysseus ERA Hub benefits from:

- Sharing knowledge and transferring innovative solutions from local to global levels.
- Flexibility and the ability to address global problems based on sharing capacities, infrastructure, knowledge, and stakeholders with global impact.

- Increased trust in the quality of the educational and research-innovation system of the alliance.
- Achieving an increased positive impact on society and government policies.

Conclusion

This guide provides a comprehensive roadmap for innovation hubs, living labs, and higher education institutions (HEIs) to successfully transform into ERA Hubs. Drawing from the Ulysseus Alliance's experiences, the guide offers practical and actionable insights and best practices that can be tailored to different contexts across Europe to enhance research, innovation, and societal impact.

The Ulysseus initiative has made significant progress in its mission to become a key European Research Area (ERA) Hub, emphasizing the integration of collaborative research and education across various European universities. Through the strategic implementation of **Innovation Hubs** (IHs) around its **innovative governance structure**, Ulysseus as a model of **strong academic partnerships** demonstrates how to foster an inclusive and innovative research and innovation ecosystem. These hubs act as crucial nodes that **connect researchers, educators, and industry stakeholders** across Europe, promoting a transdisciplinary **approach** to addressing pressing societal challenges and **aligning with ERA priorities**. By **embedding IHs and living labs within educational structures**, Ulysseus creates a hands-on, real-world learning environment where academic research directly contributes to solving practical, industry-relevant problems.

A key achievement of the ERA Hub transformation efforts has been the ability of the international HEI ecosystem to harness the **synergistic effects** of various ERA policy elements. Notably, the **sharing of research infrastructure** has facilitated a more collaborative and resource-efficient approach to scientific inquiry across institutions. The transformation process emphasizes **open science** and **open classes**, democratizing access to knowledge, broadening participation in research, and promoting a more inclusive approach to education and innovation. This is further supported by the implementation of numerous **training programs** and **mobility opportunities** for researchers and students, enhancing their skills and global perspectives.

Living labs are integrated as cornerstones of the ERA Hub model and providing dedicated support services such as **internationalization, data management, and incubation programs**. **Internal ecosystem's R&I networking and embedding living labs within educational programs** are driving innovation and skill development. It is crucial to emphasize that living labs play a dual role within the Ulysseus framework, serving both horizontal and vertical functions within the research and educational matrix. **Horizontally**, they are key to integrating research activities across disciplines, not only enhancing the breadth of educational offerings and research outputs but also contributing to the development of the internal ERA Hub ecosystem. This horizontal role is essential, as living labs must leverage research and innovation to support the growth and evolution of the ERA Hub itself. **Vertically**, they deepen the impact within their specific research domains by ensuring that outcomes are not only

theoretically sound but also practically applicable, directly influencing industry practices and addressing societal needs.

Despite these achievements, the ERA Hub model is an evolving and open concept, one that must remain adaptable to new insights and approaches. To truly enhance the societal impact of HEIs and European innovation ecosystems, the model should continue to incorporate diverse perspectives and best practices, share best practices between alliances or other innovation partnerships. There is a pressing need to further address gaps in **widening participation**, particularly by intensifying the involvement of countries less represented in the ERA and by leveraging open science through specific governmental support mechanisms.

The Ulysseus project exemplifies this ongoing journey toward a more integrated, innovative, and inclusive European research and education landscape. However, realizing the full potential of the ERA Hub model requires **collective effort** and active **knowledge-sharing** among different alliances and stakeholders. Therefore, we call upon institutions, policymakers, and innovation ecosystems to collaborate more intensively, sharing their experiences and strategies for implementing the ERA Hub model. Only through such joint cooperation can we drive systemic change, fulfil the priorities of the ERA policy, and achieve lasting societal impact of ERA across Europe.

Annex 1: Comprehensive Example of ERA Hub Transformation Strategy Implementation in TUKE IH

To illustrate a good practice on the potential of synergy between innovation hubs, living labs, and other structures of the educational and R&I European alliance and how it contributes to ERA policy, we will show more concrete examples of sub-processes in and outside the IH TUKE ecosystem.

The transformation of the Innovation Hub approach to a complex ERA Hub model is based on the ability, capacities, and measures contributing to the fulfilment of ERA policy goals and priorities in a broader range of areas and strategic documents. Their main goals, measures, and elements were presented in Fig. 5 ERA Hub model of Ulysseus with ERA elements.

However, the original intent to establish Ulysseus European University as an international ecosystem was a generic factor. Within this international environment, several models are generated for development in all areas of the academic sector with the intention to increase its quality, attractiveness, and impact on society.

In the transformation process to an ERA Hub, we use a combination of existing successful practices and models from Ulysseus partners, development activities funded by public sources, as well as initiatives by researchers within their activities.

The main role in the transformation process, therefore, is played by the identification of good practices, support for their transferability and internationalization, as well as integration with synergistic activities from other areas or elements of the ERA policy matrix. This mutual synergy of good practices, an international environment, and the development of breakthrough and systemic measures and solutions for the development of the ERA Hub environment form the main backbone of transformation efforts.

In the following sections, we will present an example of the transformation of a local living lab approach to an ERA Hub within the Innovation Hub of the Technical University of Košice (see

Annex 2: Ulysseus European University

The Ulysseus European University (www.ulysseus.eu) is one of the 24 European Universities selected in the second pilot call for proposals under the 2020 Erasmus+ work programme as a part of the European University Initiative (EUI). It was launched in 2020 with the 6 founding members – universities from Spain, France, Italy, Slovakia, Austria and Finland. After completion of the Design phase (2020 – 2023), the current

Consolidation phase started with adding 2 new members and securing the funding for the period of 2023 – 2027.
The Ulysseus European University comprises eight diverse universities from European regions, including **five comprehensive universities** (University of Seville, University of Genoa, Université Côte d'Azur, University of Münster and University of Montenegro), **one technical university** (Technical University of Košice) and **two universities of applied sciences** (Management Center Innsbruck and Haaga-Helia University of Applied Sciences).

Therefore, the **Ulysseus campus integrates four types of European regions** (according to the categories set by EUROVOC): from the oldest to the youngest, from comprehensive to specialized business and technical Universities, from established, research-based Universities, to experts in entrepreneurship and academic innovation.

This diversity of universities, countries and regions has helped to create a complementary, dynamic and versatile European University, together with more than 150 associated partners, to develop an agile, sustainable and proactive Innovation Ecosystem, which boosts synergies among the four missions of Higher Education institutions: education, research, innovation and service to society, to address UN, European, regional and local challenges.

The Ulysseus Innovation Ecosystem is founded on two pillars: the Ulysseus Community (university partners, associated partners, citizens) and the Ulysseus Campus (structures developed within the alliance).

The Ulysseus Ecosystem rests on two solid foundations: the Ulysseus Community, representing the helix and the Ulysseus Campus, with new and innovative joint structures.

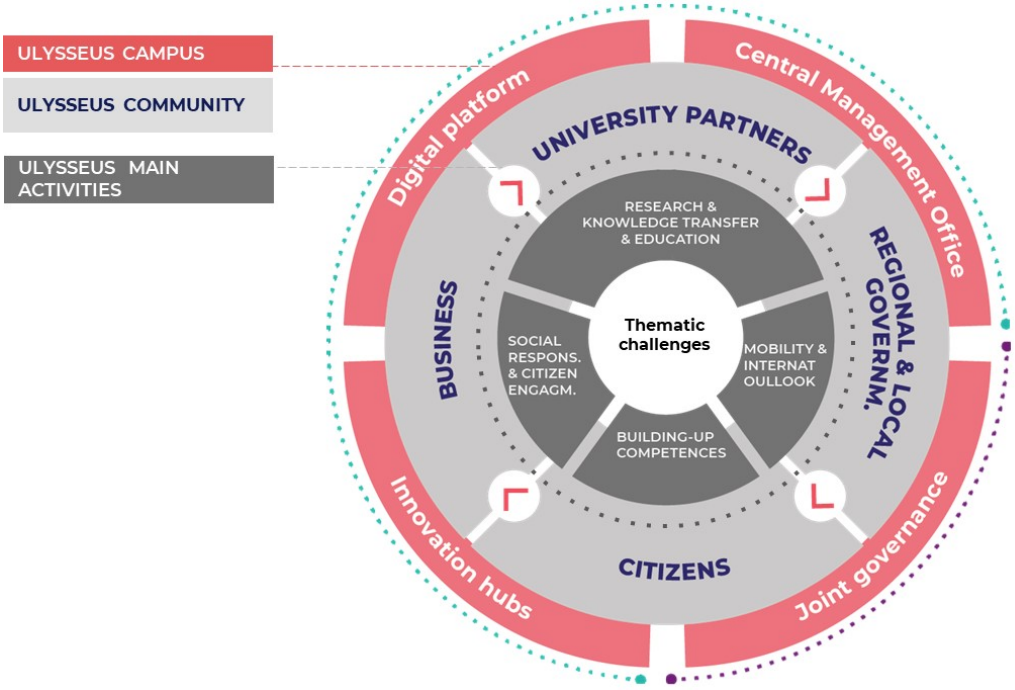

Figure 9 Ulysseus Innovation Ecosystem

The **Ulysseus Community** consists mainly of 8 university partners with the University of Sevilla as the alliance coordinator. The Community encompasses also more than 228 thousand students, 23 thousand staff (including 9 thousand academic staff/researchers), 136 faculties, 82 research centres and 1 686 research groups.

In addition to this, the Ulysseus Community relies heavily on 150 of its associate partners. The role of these partners is to contribute and support the Ulysseus alliance evolution in terms of strengthening the position of the alliance and interconnecting stakeholders in its 8 regions. Ulysseus also shares a strong involvement in regional and local development. Among the associate partners there are regional governments, city halls, NGOs, student and professional associations, clusters and private companies.

The **Ulysseus Campus** introduces three new jointly created structures: the **Central Management Office** (CMO), the **Digital Platform, Ulysseus Student Association** and eight **Innovation Hubs** (IHs), aligned with eight research and development challenges, prioritised by our regions and cities.

The Campus is a **territorial and digital** entity to interconnect the community, co-evolving capabilities around a shared set of knowledge, skills, technologies and co-operative work, for contributing to regional and local growth.

With an **integrative and democratic governance system** with full participation of the community, Ulysseus is an inclusive and open European University ready for going beyond 2023, with a new legal statue for the alliance.

Ulysseus Innovation Hubs

Understanding the alliance as an Innovation Ecosystem developing solutions for specific R&D challenges by Innovation Hubs is Ulysseus's unique and distinguishing feature. Innovation Hubs are devoted to developing solutions for eight specific and transversal R&I regional and local challenges, turning ideas into reality. Ulysseus main activities are co-created and developed in the heart of the Innovation Hubs. Collaboration and cooperation are the base of these structures, each one lead by the strongest partner in the R&I challenge in collaboration with all the rest through. These challenges have been better aligned with the regions and local governments priorities for the following years and the strategy of each partner, for boosting the activities impact. These activities include European joint degrees, joint Erasmus + and Horizon Europe projects, an incubator for spin offs, a joint research centre, a Living lab and an Open class settled in collaboration with the city government.

The eight challenges selected for the Ulysseus' Consolidation Phase (2023 – 2027) are priority topics in most of the RIS3 and cities' strategic plans of Ulysseus Alliance, and also of UN SDG, European Green Deal, and Horizon Europe missions and clusters:

1) **Sustainable Energy, Transport, Mobility for Smart Cities** (University of Seville)
2) **Ageing & Wellbeing** (University Côte d'Azur)
3) **Robotics** (University of Genoa)
4) **Digital Transformation of Industry** (Technical University of Košice)
5) **Sustainable Entrepreneurship & Impact** (MCI Innsbruck)
6) **Applied Artificial Intelligence for Business & Education** (Haaga-Helia)
7) **Socio-ecological Sustainability** (University of Münster)
8) **Cybersecurity** (University of Montenegro)

With the Consolidation phase of Ulysseus (2023 – 2027) some IHs changed their thematic challenges in order to have them more aligned with the partners' R&I strategies: MCI Innsbruck changed the topics from Food, Biotechnology and Circular Economy, University of Genoa changed from Tourism, Arts and Heritage to Robotics. Two more IHs developed their thematic challenges to be more specific: Technical University of Košice adjust the topic from Digitalisation to Digital Transformation of Industry and Haaga-Helia from Artificial Intelligence to Applied Artificial Intelligence for Business & Education.

This institutionalised cooperation for education, research and innovation in the heart of the IHs lead (though specific activities) to a systemic, structural and sustainable impact for the European Education, Higher Education & Research Areas, sharing knowledge and spreading best practices.

Detailed descriptions of selected Ulysseus IH are in the Appendix 3.

In general, each Ulysseus IH operates one joint research centre, one incubator for start-ups, one living lab for liaison, brokerage and joint designing, fostering multi-stakeholderism and the engagement of citizens. IH will also be participating in the activities of Ulysseus open classes. This structure is aimed to foster cooperation among the community representing the helix and turning ideas into reality. In this sense, the Matching4Coop application (M4C App), developed as part of Ulysseus Digital Platform, will be a digital tool for exchanging ideas, products and services, and for partners search inside Ulysseus community.

Joint research centre as a part of Ulysseus IH has the following main components: joint workplace between university and partner from ecosystem, shared technological equipment and personal expert capacities open for partners and defined thematic scope.

Incubator creates a supportive and motivational environment for development of start-ups and spin-offs launched by staff, students, faculty or partners from ecosystem. Entrepreneurship acceleration can be offered also for early-stage start-ups (in pre-incubation phase).

Living lab is a place to develop training through research and work-based training in liaison with the partners in Ulysseus Community. It facilitates and fosters open, collaborative innovation, as well as a real-life environment where innovation processes, experiments and solutions are developed and tested. For each living lab, a specific implementation model will be developed, depending on the challenges to be tackled.

Ulysseus IHs can be described also as technology transfer interfaces positioned in Ulysseus Community facilitating knowledge transfer and boost of innovation. Ulysseus IHs have their place in the structures of partner universities, while flexibility in the Ulysseus governance structure allows each partner to organise its IH based to its local conditions and environment.

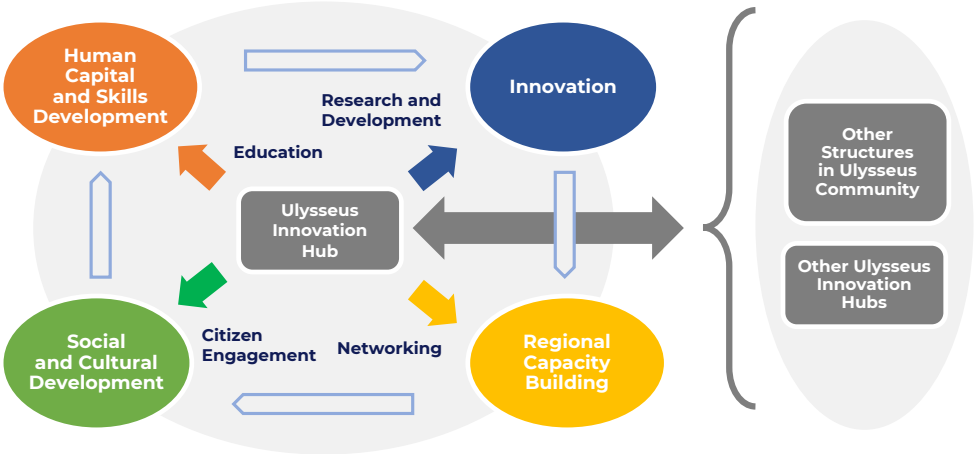

Figure 11 Interactions of Ulysseus Innovation Hub into the local and regional development

In the context of regional development, Ulysseus Innovation Hub interacts in the cycle where thanks to its interventions (in the education, R&D, citizens engagement and networking activities) the areas of innovation, human capital and skills development, social and cultural development and regional capacity building are supported and further developed. Involvement of local and regional stakeholders in this process is very crucial – the Ulysseus Community achieves this through associate partnerships with local and regional government and other key-players. These associate partners do not have only cooperation link to their local partner university but are welcomed and open to cooperate with other partners in the broad the Ulysseus Community (universities, innovation hubs, other associate partners).

Unique combination of components of the Ulysseus Innovation Hubs (joint research centre, incubator, living lab etc.) multiplied by integration in the coordinated and strategically aligned the Ulysseus Community creates a systematic approach on the university level to boost innovation. Connection among all actors in the community is of utmost importance – research teams across partner universities are being connected and stimulated to communicate and work together and share their results in order to create a motivational environment to generate new innovative ideas and solutions. Associate partners are connected and offered collaboration opportunities which might enhance their own operation and strategy.

Understanding the process of technology transfer enables Ulysseus to support efficiently the creation of innovation. Abundant pile of help and supportive mechanisms for researchers and students who want to develop their ideas in the working project is being systematically and continuously built in the alliance.

Ulysseus Governance Model

As all structures, also Ulysseus European University relies on efficient governance model comprising from following organizational structure incorporating distributed innovation hubs with its organisational structure. Strategic and operational level of the governance model is presented on the Figure .

The Ulysseus is using the **RADAR** as observatory and monitoring progress measure analysing research and innovation trends. The Ulysseus RADAR is the observatory for accurate following up, risk management and necessary adjustments of Ulysseus. It is also the Ulysseus reference structure to observe short- and long-term changes in economy, society, job market and competences. RADAR gathers Universities pedagogical, social, R&I, technological and economic experts know, how to internally evaluate the progress of Ulysseus. RADAR is collecting information from R&I sectors, based on the R&I Agenda, specifically on the Innovation Hubs areas. It creates from RADAR an instrument for foresight and advisory tool for R&I issues. One of the areas of monitoring, will be the fulfilment of relevant KPIs related to ERA policy fulfilment.

This will lead to the identification of challenges and convergences to be competitive in Horizon Europe and other R&I Programmes, as well as to a scheduled plan to gain visibility and positioning of Ulysseus partner Universities in the main international rankings through improving the scientific productivity in the thematic challenge-related areas.

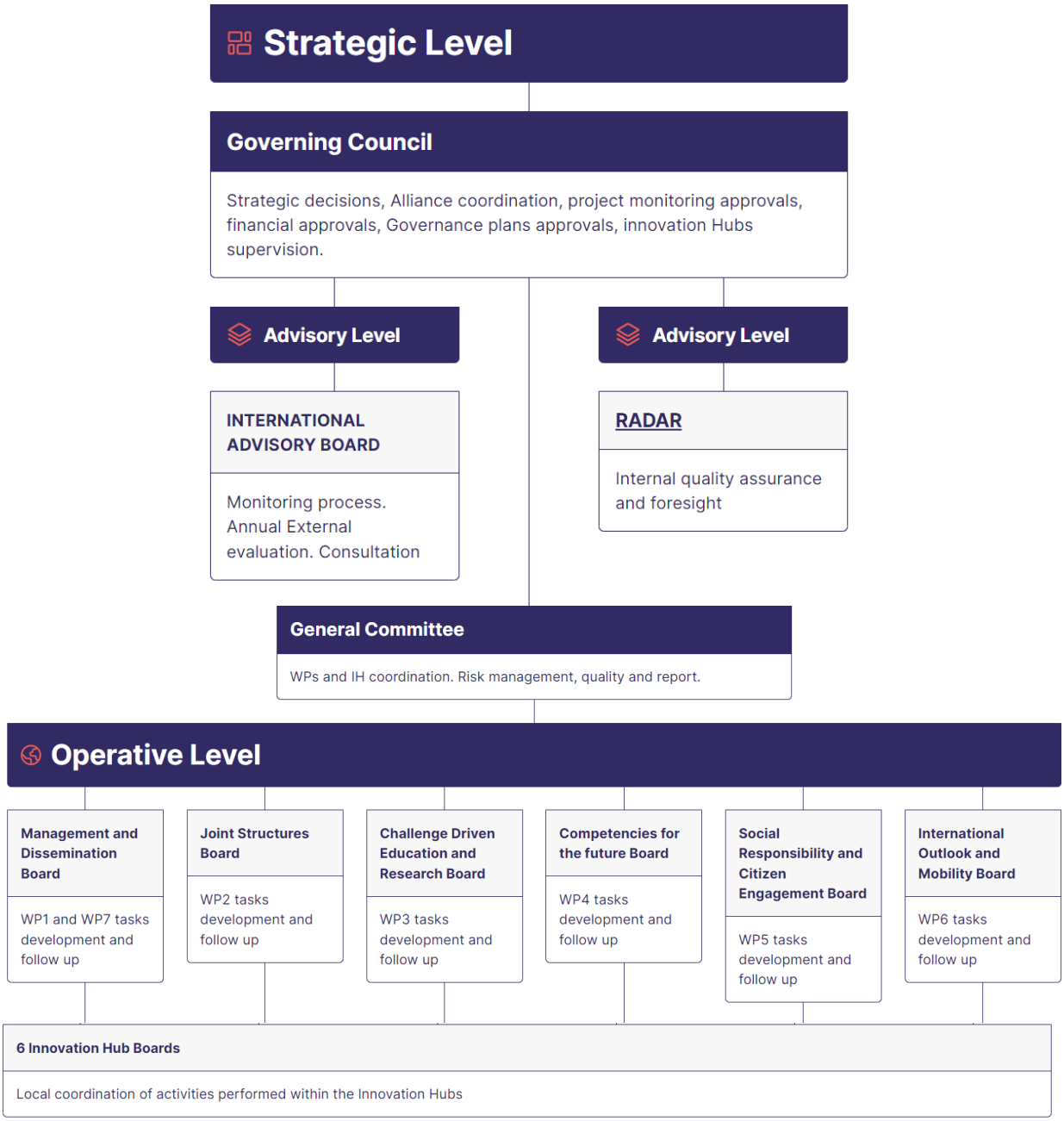

Figure 12 Ulysseus Governance Model (Design Phase, 2020-2023)

Annex 3: Description of Ulysseus Innovation Hubs.)

Living lab enhancement within the broader concept of transformation into the ERA Hub model based on a distributed international system for connecting living lab environments and innovation hub environments in the Ulysseus ecosystem is illustrated on figure below.

From the figure, it is evident that some connections of living lab environments within the vertical and horizontal structure of R&I activities have added value based on:

- Connection with the Ulysseus R&I ecosystem, which in turn develops the living lab further,
- Integration of the environment, processes, and activities of higher education,
- Integration of external and internal forms of informal education,
- Integration of innovation ecosystems (innovation hubs and startup centers) in local and international environments,
- Integration with stakeholder platforms.

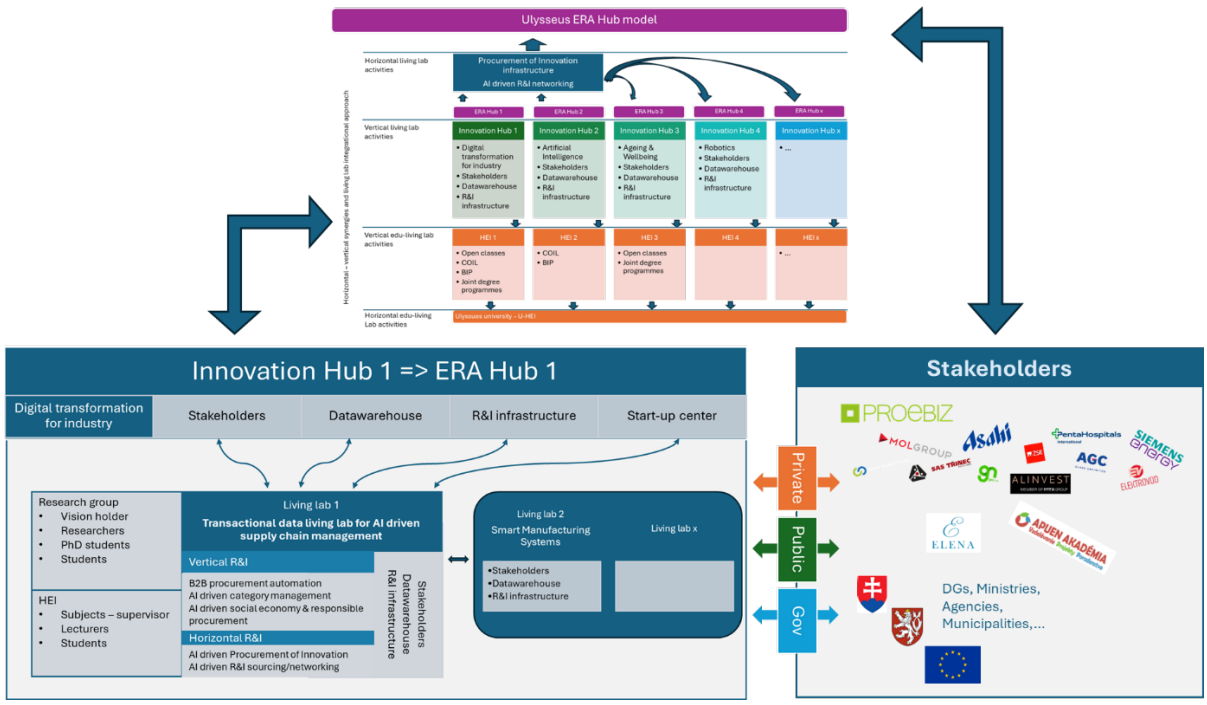

Figure 5 Framework of distributed cooperative ERA Hub model presented on TUKE ERA Hub example

We will present the process of these systemic changes based on ERA Hub principles using the example of the mentioned living lab, which, in the transformation process achieved through internationalization and the Ulysseus Alliance governance model, was built on the development of existing research, which gradually transformed into a Living Lab model and subsequently began to take advantage of the international environment. However, with its potential synergistic effects, existing solutions, and concepts, it also began to contribute to horizontal activities and the development of the global Ulysseus ecosystem. With this, we want to highlight the importance of vertical-horizontal R&I and educational activities within local living labs for the development of the ERA Hub model.

In brief, we mention the evolutionary aspects of this transformation process as an example of one of the good practices and synergistic spillover effects, which we will explain later.

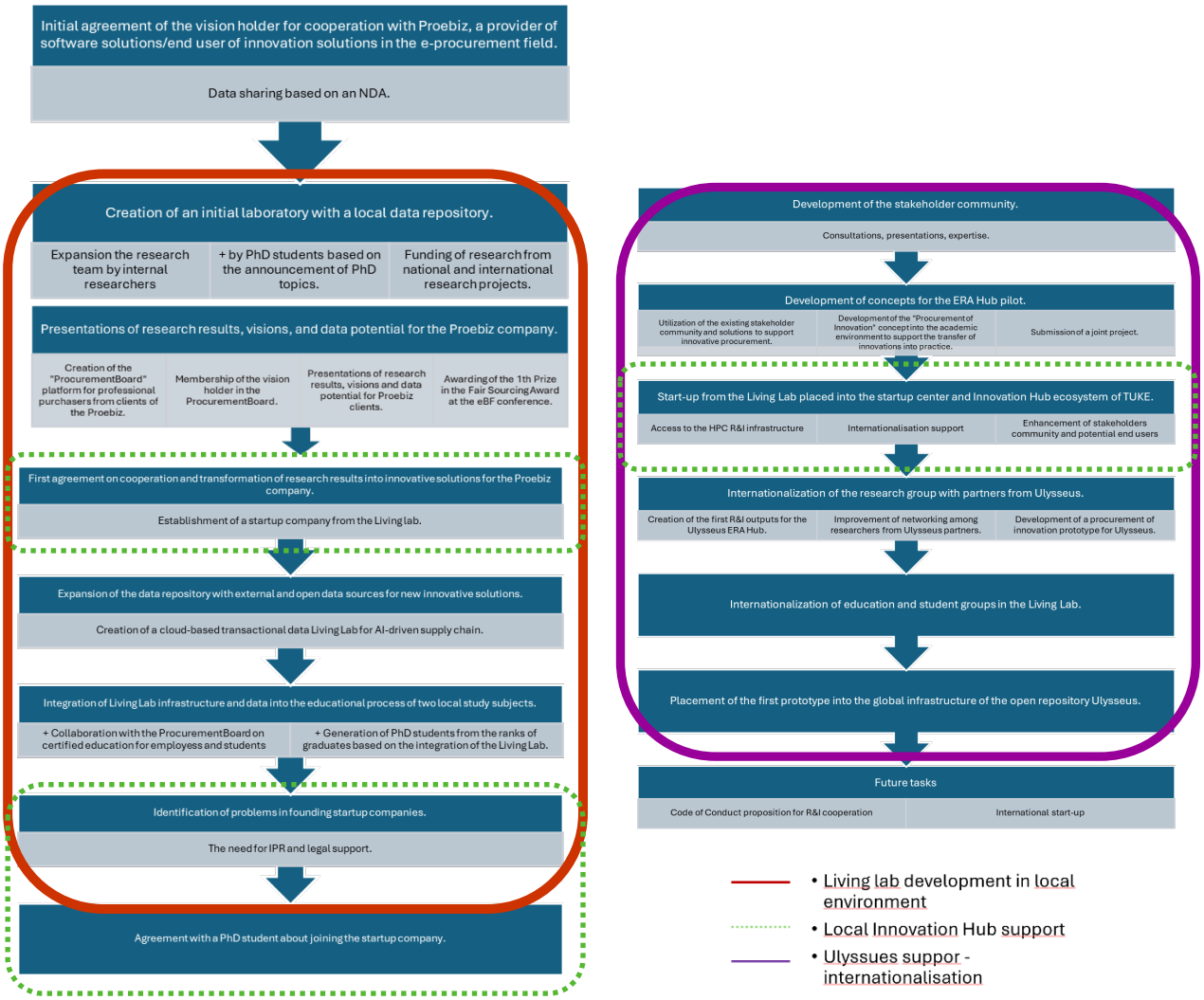

Figure 6 Evolution of living lab into ERA Hub within the Ulysseus ecosystem

Fundamental Key Success Factors in Establishing and Managing Living Labs as ERA Hub element

We will now present in detail the transformation processes of the Ulysseus ecosystem. As can be seen, the basis is the research effort of the vision holder, who in the context of developing their scientific field developed a living lab for research purposes over real data, research which has high potential to bring results applicable in practice.

In this case, the living lab was founded on data technologies and innovations and therefore was developed in a virtual cloud environment. In this case, the successful and alternative factors for the development of the living lab are:

Identification and support of the vision holder with real research results, potential capacity for rapid innovation, with the advantage of visions for breakthrough and strategic (long-term) innovations.

Creation of collaboration with the end-user community: Presentations of research results and potential and visions on end-user platforms, e.g., professional conferences and workshops, which are often more effective than inviting end-users to university/academic events.

Agreement on data access for the purpose of research development in the area and potential for innovation development for end-users in the following models:

- In the case of cooperation with a digital service provider to their end clients, the data of which we need to process: a basic NDA model (between the provider and the vision holder[2]), comprehensive NDA model (between the provider and each accessing researcher), direct model between the clients of the provider, who are legally the owners of the data generated in third-party software, and the vision holder (ensuring subNDAs for other researchers already in the vision holder - researcher model).
- In the case of cooperation directly with end-users as separate entities generating data in their legacy systems, signing separate NDAs with the responsible researcher of the living lab or relevant Innovation Hub, who secures subNDAs with its members.

Creation of various models for data storage and access:

- Agreements on integration cooperation platforms and research with data directly in the systems of end-users/providers, where researchers are not

[2] The responsible researcher, whose responsibility is then to transfer the NDA in a subcontracting model to collaborating researchers or students, and the provider's responsibility to ensure a data access agreement with their clients and alert them about the transfer of sensitive data to third parties.

authorized to download and disseminate data, and all research is carried out by remote access to third-party systems.
- Generating local repositories and sharing stored data in various formats, which are more convenient for researchers in terms of portability, offline work but with increased risk of data leakage for the end-user.
- Creation of a data repository in a cloud environment with managed accesses, roles, and cooperative mechanisms allowing the integration of external ICT services mainly for sharing computational power, where especially in the case of big data, the ability to perform computationally intensive operations is an advantage for a larger number of researchers with basic ICT equipment.

Creation of a Code of Conduct system, which is to ensure proper behaviour of research team members, and which mainly addresses the following issues:
- Possibilities for further use of data for separate research by a specific member of the research team.
- Rules for publishing research results.
- Possibilities for presenting research results and data in an external environment.
- Possibilities for founding startups based on research results, infrastructure of the living lab.
- Rules for managing revenues and their use for the development of the laboratory and overheads in the case of a contractual relationship with a commercial consumer.

In cases of other living labs that require physical laboratory spaces, such as for testing building structures, biotechnological laboratories, and others, not only the infrastructure of digital services and the preceding rules are important, but also the creation of physical laboratory infrastructures, whose development is funded by mainly from structural funds to a lesser extent by European R&I programs. However, in some cases with significant contributions from private funding through sponsorship gifts for the purchase of infrastructure with sponsor presentation in the laboratory, or cooperative models, where the sponsor gains certain results or research services for free.

These factors of living lab development are fundamental key factors for credible joint research and cooperation, ensuring research integrity and an environment with clear rules.

Added Value from ERA Hub Transformation and Related Internationalisation

The presented living lab at one phase faced different challenges where the ERA Hub model was considered very suitable and promising for further development and impact. The integration of Ulysseus R&I capacities, internationalization, and support

services (like IH support, project management office support, promotion/visibility, and many others continually developing also by feedback from living labs) sharing with the local living lab is a cornerstone of the Ulysseus global ERA Hub transformative approach with the following crucial added values:

- **Internationalisation and multidisciplinary of research groups** and living labs,
- **International living lab integration into the education** and transformation to eduLivingLab
- **Lessons learned, success factors and challenges from other ERA measures and ERA Hub actions** including support services to researchers, open science, share R&I infrastructure

Internationalisation and Multidisciplinary of Research Groups

One of the main pillars of the ERA is internationalization and the enhancement of scientific quality to achieve a greater societal impact. Ulysseus has established several strategies to increase the internationalization and interdisciplinarity of research groups surrounding the living labs of its members. These strategies focus on networking and managing potential researchers. However, there is no one-size-fits-all strategy. The complexity of research activities and related commercialization efforts may vary across different domains and the purposes of research groups (open science, social innovation, private innovation, etc.). This guide presents good practices based on the initial creation of research groups around several living labs, with more details from Transactional data living lab (TDLL) on TUKE.

The primary goal of joint research actions within the Ulysseus Alliance is to increase the visibility of researchers and their expertise or results to support vision holders in networking or brokerage activities. This action also has a broader impact, as R&I visibility is crucial for translating R&I results to society or the economy, especially in the Procurement of Innovation model.

Consequently, strategies for enhancing the visibility of researchers and their expertise, as well as for mapping suitable researchers to the vision holder's R&I networking requests, have been implemented, and some have already been tested.

To support the internationalization of research groups, the following strategies were discussed and established within the local Innovation Hub, as presented in good practice section. Within the Innovation Hub, a steering committee was established to support IH activities. After the first meeting, where vision holders request Ulysses' support for the internationalization of their research group or living lab, the IH is responsible for identifying suitable researchers or research teams within their

respective university ecosystem. Identifying researchers requires increasing the visibility of researchers and their results.

For the visibility of researchers, the following strategies were set up:

- **Strategies for direct researcher identification** (presented in good practice of internationalisation of research groups at IH TUKE): researcher profiling through a questionnaire survey provides structured data in a search service, or IH service support or AI-driven R&I networking tool as an R&I sourcing feature.
- **Ulysseus R&I social network Match4Coop** for the socialization of researchers in a virtual environment based on social media approaches, providing opportunities to present the researcher and their research, follow researchers, present interesting actions and events and discuss R&I presented results.

Lessons learned and recommendations from this type of ERA Hub action show that all actions have their benefits and limitations. Therefore, we recommend deploying a combination of them based on the following analysis:

	Benefits	Limitations	Challenges
Questionnaire based profiling of researchers	• Provides an opportunity for researchers to present themselves based on their preferences without needing to publish everything. • Allows for showcasing R&I interests in areas where the researcher has not previously been active. • Enables the collection of results from hidden innovations and solutions, prototypes at various TRLs that have not been published or are not publicly available.	• Offers the possibility of not responding to the questionnaire, thereby reducing the number of profiled researchers and the R&I visibility and potential of the organization. • Structured responses do not allow sufficient detail in the R&I area. • Understanding the potential to expand R&I results and the researcher's expertise into other areas.	• Offers the possibility of not responding to the questionnaire, thereby reducing the number of profiled researchers and the R&I visibility and potential of the organization. • Structured responses do not allow sufficient detail in the R&I area. • Understanding the potential to expand R&I results and the researcher's expertise into other areas.
IH service support	• Offers the possibility of not responding to the questionnaire, thereby reducing the number of profiled researchers and the R&I visibility and potential of the organization. • Structured responses do not allow sufficient detail in the R&I area. • Understanding the potential to expand R&I results and the researcher's expertise into other areas.	• Offers the possibility of not responding to the questionnaire, thereby reducing the number of profiled researchers and the R&I visibility and potential of the organization. • Structured responses do not allow sufficient detail in the R&I area. • Understanding the potential to expand R&I results and the researcher's expertise into other areas.	• Offers the possibility of not responding to the questionnaire, thereby reducing the number of profiled researchers and the R&I visibility and potential of the organization. • Structured responses do not allow sufficient detail in the R&I area. • Understanding the potential to expand R&I results and the researcher's expertise into other areas.

	Benefits	Limitations	Challenges
AI driven R&I networking/brokerage tool	• Enables searches based on available data, mostly scientific articles within open access. • Allows understanding of contextual knowledge from extensive texts of articles, their similarity with the research areas of the vision holder looking for cooperation, potentially complementary expertise, for example, for extending methodology or application in another domain. • Allows for real-time identification and contacting of the most suitable researchers and identifying their networks of co-authors. • Enables automated classification of researchers by self-defined parameters of quality/reputation. • Enables automated overview of collaboration on published articles, submitted projects, etc., as input into reporting activities. • Allows the extension of AI-acquired knowledge for other areas of use.	• Does not allow identifying hidden knowledge such as unpublished outputs, prototypes, or a researcher's interest in a new area. • Requires downloading, processing, and transforming data, which is financially more demanding. • It may be challenging to achieve the required accuracy and quality of the model.	• Expand the data structure for ML/LLM models with data from questionnaire surveys, project records, or internal repositories. • Enable automated downloading of project results in the form of deliverables directly from the pages of projects identified within R&I programs.
Ulysseus R&I social network	• Allows presenting research in text and image form. • Enables researchers to follow the vision holder and be informed about his research activities. • Allows participants of the social network to use standard functionalities of social media. • Possible to discuss.	• It is voluntary, which reduces the number of vision holders or researchers willing to engage in this channel. • If a researcher is not following the vision holder, it is difficult to search for contextual information.	• Increase researchers' participation in presenting their results. • Support presentations especially of research with breakthrough discoveries and exceptional research teams.

Table 1 Lessons learned in researcher networking within the international R&I ecosystem

After the phase of identifying researchers, a strategy for selecting research teams for Ulysseus support services is set within the innovation hub according to criteria:

- Alignment of the research area with the focus of the Innovation Hub
- The innovative potential of the research topic and its transferability to practice
- Added value to the local IH and relevant university
- Quality of results in the form of publications, submitted projects, and startups
- Existing capacity of the vision holder and his community of stakeholders

After selecting the research groups, IH with Ulysseus structures and support services ensures support in the areas of visibility/promotion, support of the project management office in submitting project proposals, innovation support (mentoring schemes, consultations), support for expanding the community of stakeholders about Ulysseus stakeholders, support for visibility at working meetings with governmental bodies, European networks, EC, and other activities continually developing within Ulysseus projects.

The duty of the vision holder as the founder of an international research group is to:

- Organize a kick-off meeting of the research group where it is necessary to agree on rules of behaviour and procedures for solving agreed research tasks and implementing outputs.
- Adhere to set KPIs and the implementation of outputs.
- Report results to the local IH from which the vision holder originates.
- Promote and share results on open science platforms of the Ulysseus alliance, or on the Match4Coop platform.

Important lessons learned in creating and managing research groups include:

Implementing a code of conduct – for open sharing of visionary ideas, access to data, and the implementation of joint outputs in a high-trust environment. For this purpose, the suitability of introducing Online Dispute Resolution models has been identified, where conflicts are resolved by mediation or alternative methods in case of Code of Conduct violations. Specialized services of one of the IH or its university, where researchers or experts in ODR, mediation, or alternative conflict resolution approaches operate, can handle these conflicts within the development of their living lab or just as an internal subcontracting service to the satisfaction of the international ecosystem.

In identifying researchers from the international environment, it proved appropriate **to identify and invite researchers from other disciplines** with a broader overview of research activities and cross-sectional research areas, such as researchers and experts from the creative industry, circular economy, inclusion, etc., to induce synergistic effects and the possibility of identifying complementary research sub-groups.

A very important success factor is also **strong leadership** of the research group.

The high added value of this internationalization strategy for research appears to be:

- **Expanding methodological views of researchers** from other environments and domains, which opened up many new approaches and types of innovations in the given topic.
- **Utilizing the results and participation of researchers in the educational environment**, which was identified by members of the research team, thereby also internationalizing education and the transfer of R&I knowledge to education.
- **Sharing infrastructure within the internationalized living lab**, where, for example, in the area of research data warehouse, not only are the original data of the living lab and the vision holder's research group shared with other members and their external environments, but this data warehouse is also enriched with data from these external environments, which is often a suitable initial activity of the research group. During the aggregation, cleaning, and transformation of data, research teams begin to understand each other more

and collectively come up with new uses of data, which is important to capture in an online collaborative environment (e.g., MS Teams, GitHub…).

- **Creating new possibilities for supporting the financing of R&I** by synergic sharing of R&I solutions or project proposals through calls within national funding programs of members of the international research group for capturing suitable calls (for research and development with an existing project idea in another country, if there are no suitable calls in the vision holder's country), testing the results of successful projects in one country in the environment of another country, expanding the focus of successful projects within the calls of one country based on methodological, domain, or other extensions in another country, internationalizing research teams in national calls.

A specific contribution of the TDLL research group was the expansion of vertical research focus in the area of data support and the use of artificial intelligence for decision-making in procurement processes, where one of the elements of effective procurement is the procurement of innovations or defining the innovative value or parameter of the procured product or service.

Two horizontal good practice services to increase the visibility of R&I results of researchers from member organizations of the Ulysseus alliance can be defined as a result:

1) R&I sourcing tool for Ulysseus researchers with potential to provision to external ERA Hubs or ecosystems of alliances.

2) Procurement of innovation service infrastructure utilizing benefits from existing partnership with procurement SW provider and relevant supply chains with the possibility to integrate Ulysseus R&I ecosystem directly into the supply chains across Europe. This ERA Hub feature was presented as a good practice section and more detailed description provided in Annex 1.

R&I Sourcing Tool for Ulysseus Ecosystem as a Core ERA Hub Feature

One of the efficient ERA Hub support services contributing to the ERA priorities for science quality, internationalization, and translation of R&I results into the economy was identified as a service based on AI and data-driven model extracting R&I related knowledge from open science/publishing sources on up-to-date research results published within scientific papers where a suitable AI model was deployed and tuned.

The prototype of the tool was the result of TDLL joint research work based on preliminary understanding from procurement of innovation service infrastructure development initiative. This initiative is also a part of TDLL based on discussion within Procurement Board presented earlier as a strong community of stakeholders.

The tool provides possibilities like a Google search engine for researchers to search scientific papers and authors based on a similarity measure (applied by a related AI model) comparing similarity in text and context between text or title+abstract uploaded by a researcher and papers already published within specific repositories for scientific publishing (e.g., Scopus).

The tool provides results based on the similarity of published papers with specific meta-information like authors, affiliations, time, keywords, contact addresses, etc. These results are ranked according to the similarity level and can be processed in the form of network graphs of research groups identified from the model or some statistical analysis on specific parameters.

Lessons learned from this ERA Hub support service are:

Utilizing cutting-edge technologies like gen or LLM AI in support by researchers and living labs with relevant expertise allows significantly improving internationalization of R&I collaborative space within an international ecosystem of Alliance or global ERA Hub and allows providing synergic effects of vertical research focus of living lab.

Data sources for the model should be enhanced as much as possible utilizing internal initiatives, measures, actions of Ulysseus members like existing library repositories, Ulysseus open science repositories, existing repositories of project results and reports as well as in-house processes of data collection like the questionnaire approach or mandatory reporting. This can incredibly increase R&I knowledge, visibility, and understanding of context and potential of researcher or his team to offer innovation deployable to the requirements and expectations of other researchers, industrial or public actors.

Data should be cleaned and transformed sometimes with a big effort, but incremental development is suitable.

Enrichment of additional information about a researcher, like living lab existence or other R&I infrastructure for sharing with third parties, would be beneficial.

The tool is also applicable for automated reporting of published papers, searching activities and interest assessments, related trends, and other important information for strategic governance or management of local IH and global ERA Hub.

The tool is a very good support service also for:

- **Already established living lab research groups** to invite additional researcher according to needs (new methodology, unknown domain of application, etc.),

- **End-users or market players**, for identification of researchers or international skilled research team for procurement of consultancy or RDI capacities,

- **IH managers or CSOs** supporting their researchers in networking activities.

Data sources suitable for the AI service as future good practice is therefore identified based on a combination or enrichment of AI/ML/LLM tool on open science publishing records by collection of researcher's profile within realized questionnaire surveys, researcher's tangible results in different TRL levels, internal project deliverables, internal scientific papers & report from internal library systems (esp. abstracts), internal repositories of R&I results reports, project outputs, actions, events, results, deliverables published on HE project websites using AI data processing and transformative tools and integration with internal open repository system (e.g., in our case Ulysseus open repository)

Based on the research group meeting and discussions, one member of the research group provided the opportunity to deploy the tool into the Ulysseus digital platform – open repository to share ICT and networking infrastructure and provide a relevant environment for a production version of the tool scalable and testable on a much larger number of users.

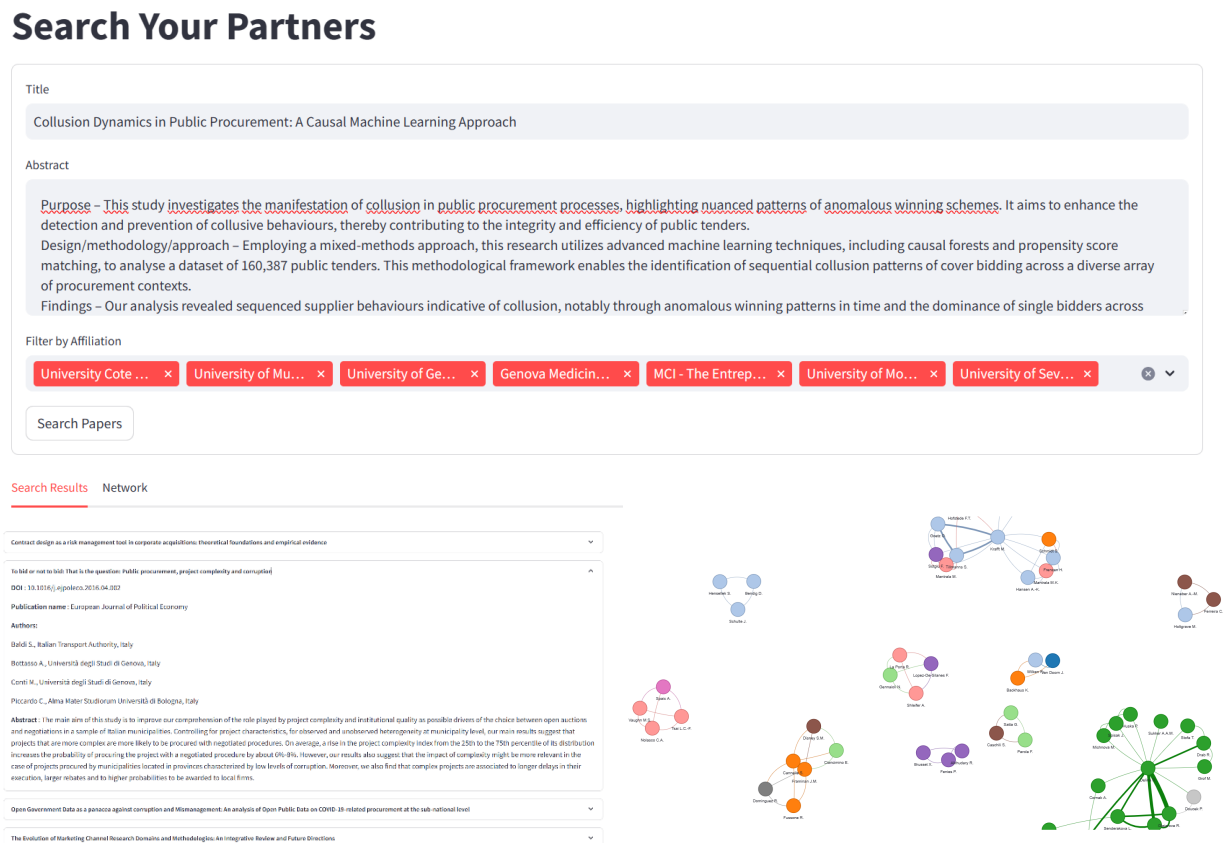

Figure 7 Example of search results, network analysis and identification of research groups across Ulysseus alliance organizations based on similarity to an article by the vision holder TDLL

eduLiving lab enhancement from TDLL integration into education

One of the next features of the ERA Hub and ERA policy's priorities is education that is more interconnected with the environment and results of research and innovation, aimed at increasing student awareness of new approaches, technologies, solutions, and preparation for decision-making in practice based on data and the latest results in science, research, and innovation. It also develops students' abilities and skills to solve problems using innovative methods in living lab environments.

The model we present as good practice comes from the expanded perspective of the eduLivingLab applied in TDLL:

1) The basis is a data warehouse developed within TDLL, cleaned and transformed for research and innovation purposes.

2) Based on the need to integrate the living lab into the educational environment of two subjects and the integration of students, the data were pre-processed in terms of anonymization or simulation of sensitive data while preserving the characteristics of the original data file. Open data were shared without restrictions.

3) In the teaching of one subject, the instruction was set so that problems were defined within semester projects by researchers (members of TDLL) and TDLL Stakeholders – representatives of companies interested in research results

4) In the course, students are educated about the possibilities of data-supported decision-making, and within laboratory exercises, student groups are formed that choose predefined topics. Groups can be formed isolated (within the course), interdisciplinary (across faculties of one university), internationally (within existing Erasmus agreements or existing educational activities of alliance ecosystems) and as part of linking educational activities of students and informal or professional education of company employees.

5) In solving the topics, students have the opportunity to collaboratively apply data-supported problem-solving solutions, come up with new ideas, propose and develop data models with evaluations of their accuracy and impact.

6) When integrated with professional courses, there are opportunities for obtaining such certification also for students within the implementation of the subject at school. Important is the agreement with the organizers of professional courses to achieve the best synergistic effect and agreements on alternative fee models for students. An example is the course Digital Procurement Team certified by companies and Proebiz provider within the ProcurementBoard platform as the living lab's community of stakeholders described above.

7) Students are mentored by researchers and lecturers.

8) Student teams present solutions, and the results are evaluated by researchers as well as stakeholders.

9) Selected solutions are tested in the real environment in TDLL and for selected problems evaluated by potential end-users.

10) In the assessment by end-users, suitable activities from TDLL and stakeholders provide students with awards for creative solutions, formulating recommendations and references into CVs and profiles of students/graduates (that are integrable with external services, or available as validation of awards when interested in a job), move student teams into the startup centre environment with a mentoring program for commercialization of interesting solutions and offer students with interesting solutions alternative forms of cooperation, e.g., joint venture.

11) Lecturers and researchers of TDLL have the opportunity to integrate this model with support services for organizing hackathons by the Startup Center in collaboration with the Innovation Hub.

Based on the meeting of the international research group of TDLL, future internationalization of this model for the winter semester of 2024 the following model was discussed:

- Student research teams will be composed of various countries and different study areas/subjects to ensure cooperation in a multicultural environment and the use of interdisciplinary knowledge in solving data-based problems.
- The community of stakeholders will also be expanded to include international players providing problem definitions with a global scope/character.
- Lecturers from an international environment will be appropriately used in lectures and mentoring of some international student groups.
- Use this model for Erasmus internships, possibly within Marie Curie doctoral studies, participation in joint degree programs, BIP and COIL actions organized by the Ulysses alliance.
- Allow students to undertake international research internships and mobilities within the given subject and problem-solving with selected stakeholders.

Lessons learned from integrating Living Labs into education:

- Integrating a Living Lab research environment with research and innovation tasks into education contributes to motivate students to stay in research, especially PhD programs, to increase awareness of the living lab's potential for the future practice environment in which the student will operate.
- Student groups and joint/international student groups within semester projects and experimentations are good opportunities for additional data collection and processing, leading to an enhanced data warehouse for living labs.
- Up-to-date R&I results awareness is improved among students, preparing

them for a future shaped by R&I after entering the world of practice.

- Improving students' skills in specific domains (e.g., in TDLL data science and AI problem solving) and motivation for creative real problem solving in a collaborative environment.
- Win-win benefits are obtained when integrating students with the community of stakeholders related to the living lab for defining real problems, assessing the solution, and identifying the potential for further industry-students-researchers cooperation.
- Communicating and co-creating with end users is appreciated by students.
- Creation of multidisciplinary international student groups for problem solving is highly expected and can lead to better results such as higher quality and impact of solutions.
- Learning in collaborative teams and educational activities consisting of students and employees from companies within integration informal or professional educational activities improves the understanding of the problem from the real world with the potential of R&I and modern educational content. In the case of certified courses, students are open to achieving this certification after successfully finishing the joint work.
- Open and transparent positive feedback for student groups and student profiles from researchers and stakeholders is very promising for students.
- Integration of research teams, living lab infrastructure, and stakeholders into the educational activities and problem solving within this presented model is opening very interesting forms of innovation models. An innovation model with Startup center or Innovation Hub support can be formed under different business models which open diversity of deployment into the practice with continual enhancing the models based on creative ideas of students: joint consortia startups (spin-offs including the university as a facilitator), student startups from local student groups, international startups (based on the internationalization of the student group model), joint startups of students, researchers, and stakeholders (where students with the promise of achieving equity in the startup company can bring significant in-kind contribution to the development or finalizing of an innovative solution into the production version), contractual model (in the form of service delivery by "freelancer"), prizes award model, crowdfunding and crowdsourcing models (according to the type of solution/innovation, where finalizing solution into the production can be additionally funded by the end-user community with existing funding and beneficial models presented on crowdfunding platforms.)

Annex 2: Ulysseus European University

The Ulysseus European University (www.ulysseus.eu) is one of the 24 European Universities selected in the second pilot call for proposals under the 2020 Erasmus+ work programme as a part of the European University Initiative (EUI). It was launched in 2020 with the 6 founding members – universities from Spain, France, Italy, Slovakia, Austria and Finland. After completion of the Design phase (2020 – 2023), the current Consolidation phase started with adding 2 new members and securing the funding for the period of 2023 – 2027.

The Ulysseus European University comprises eight diverse universities from European regions, including **five comprehensive universities** (University of Seville, University of Genoa, Université Côte d'Azur, University of Münster and University of Montenegro), **one technical university** (Technical University of Košice) and **two universities of applied sciences** (Management Center Innsbruck and Haaga-Helia University of Applied Sciences).

Therefore, the **Ulysseus campus integrates four types of European regions** (according to the categories set by EUROVOC): from the oldest to the youngest, from comprehensive to specialized business and technical Universities, from established, research-based Universities, to experts in entrepreneurship and academic innovation.

This diversity of universities, countries and regions has helped to create a complementary, dynamic and versatile European University, together with more than 150 associated partners, to develop an agile, sustainable and proactive Innovation Ecosystem, which boosts synergies among the four missions of Higher Education institutions: education, research, innovation and service to society, to address UN, European, regional and local challenges.

Figure 8 Ulysseus partner universities

The Ulysseus Innovation Ecosystem is founded on two pillars: the Ulysseus Community (university partners, associated partners, citizens) and the Ulysseus Campus

(structures developed within the alliance).

The Ulysseus Ecosystem rests on two solid foundations: the Ulysseus Community, representing the helix and the Ulysseus Campus, with new and innovative joint structures.

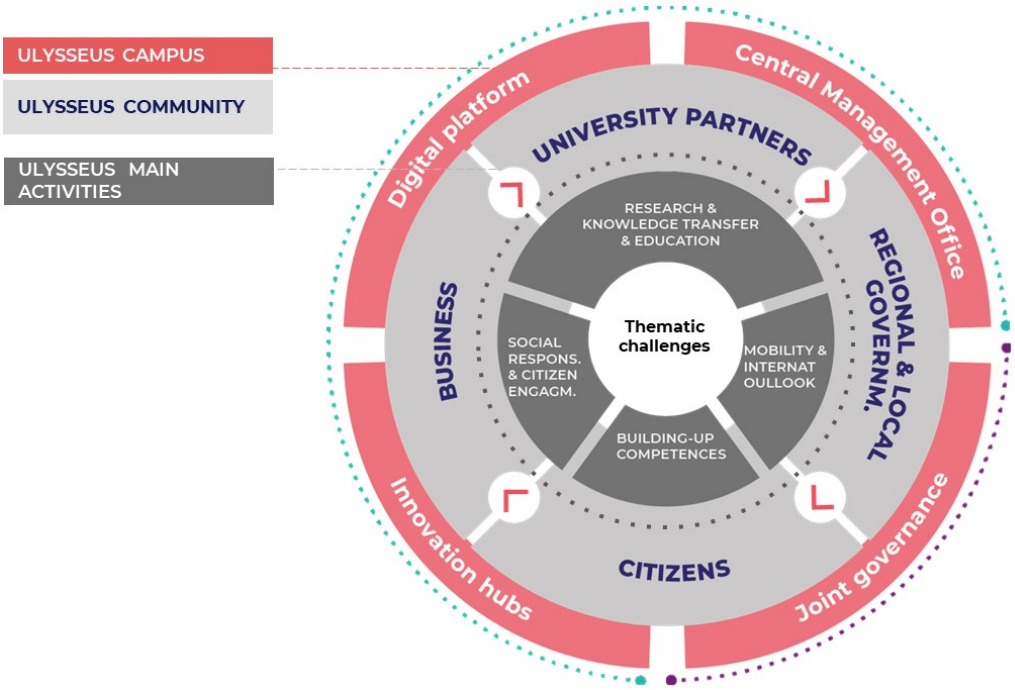

Figure 9 Ulysseus Innovation Ecosystem

The **Ulysseus Community** consists mainly of 8 university partners with the University of Sevilla as the alliance coordinator. The Community encompasses also more than 228 thousand students, 23 thousand staff (including 9 thousand academic staff/researchers), 136 faculties, 82 research centres and 1 686 research groups.

In addition to this, the Ulysseus Community relies heavily on 150 of its associate partners. The role of these partners is to contribute and support the Ulysseus alliance evolution in terms of strengthening the position of the alliance and interconnecting stakeholders in its 8 regions. Ulysseus also shares a strong involvement in regional and local development. Among the associate partners there are regional governments, city halls, NGOs, student and professional associations, clusters and private companies.

The **Ulysseus Campus** introduces three new jointly created structures: the **Central Management Office** (CMO), the **Digital Platform, Ulysseus Student Association** and eight **Innovation Hubs** (IHs), aligned with eight research and development challenges, prioritised by our regions and cities.

The Campus is a **territorial and digital** entity to interconnect the community,

coevolving capabilities around a shared set of knowledge, skills, technologies and cooperative work, for contributing to regional and local growth.

With an **integrative and democratic governance system** with full participation of the community, Ulysseus is an inclusive and open European University ready for going beyond 2023, with a new legal statue for the alliance.

Ulysseus Innovation Hubs

Understanding the alliance as an Innovation Ecosystem developing solutions for specific R&D challenges by Innovation Hubs is Ulysseus's unique and distinguishing feature. Innovation Hubs are devoted to developing solutions for eight specific and transversal R&I regional and local challenges, turning ideas into reality. Ulysseus main activities are co-created and developed in the heart of the Innovation Hubs. Collaboration and cooperation are the base of these structures, each one lead by the strongest partner in the R&I challenge in collaboration with all the rest through. These challenges have been better aligned with the regions and local governments priorities for the following years and the strategy of each partner, for boosting the activities impact. These activities include European joint degrees, joint Erasmus + and Horizon Europe projects, an incubator for spin offs, a joint research centre, a Living lab and an Open class settled in collaboration with the city government.

The eight challenges selected for the Ulysseus' Consolidation Phase (2023 – 2027) are priority topics in most of the RIS3 and cities' strategic plans of Ulysseus Alliance, and also of UN SDG, European Green Deal, and Horizon Europe missions and clusters:

9) **Sustainable Energy, Transport, Mobility for Smart Cities** (University of Seville)
10) **Ageing & Wellbeing** (University Côte d'Azur)
11) **Robotics** (University of Genoa)
12) **Digital Transformation of Industry** (Technical University of Košice)
13) **Sustainable Entrepreneurship & Impact** (MCI

Figure 10 Ulysseus Innovation Hubs

Innsbruck)

14) **Applied Artificial Intelligence for Business & Education** (Haaga-Helia)
15) **Socio-ecological Sustainability** (University of Münster)
16) **Cybersecurity** (University of Montenegro)

With the Consolidation phase of Ulysseus (2023 – 2027) some IHs changed their thematic challenges in order to have them more aligned with the partners' R&I strategies: MCI Innsbruck changed the topics from Food, Biotechnology and Circular Economy, University of Genoa changed from Tourism, Arts and Heritage to Robotics. Two more IHs developed their thematic challenges to be more specific: Technical University of Košice adjust the topic from Digitalisation to Digital Transformation of Industry and Haaga-Helia from Artificial Intelligence to Applied Artificial Intelligence for Business & Education.

This institutionalised cooperation for education, research and innovation in the heart of the IHs lead (though specific activities) to a systemic, structural and sustainable impact for the European Education, Higher Education & Research Areas, sharing knowledge and spreading best practices.

Detailed descriptions of selected Ulysseus IH are in the Appendix 3.

In general, each Ulysseus IH operates one joint research centre, one incubator for start-ups, one living lab for liaison, brokerage and joint designing, fostering multi-stakeholderism and the engagement of citizens. IH will also be participating in the activities of Ulysseus open classes. This structure is aimed to foster cooperation among the community representing the helix and turning ideas into reality. In this sense, the Matching4Coop application (M4C App), developed as part of Ulysseus Digital Platform, will be a digital tool for exchanging ideas, products and services, and for partners search inside Ulysseus community.

Joint research centre as a part of Ulysseus IH has the following main components: joint workplace between university and partner from ecosystem, shared technological equipment and personal expert capacities open for partners and defined thematic scope.

Incubator creates a supportive and motivational environment for development of start-ups and spin-offs launched by staff, students, faculty or partners from ecosystem. Entrepreneurship acceleration can be offered also for early-stage start-ups (in pre-incubation phase).

Living lab is a place to develop training through research and work-based training in liaison with the partners in Ulysseus Community. It facilitates and fosters open, collaborative innovation, as well as a real-life environment where innovation processes, experiments and solutions are developed and tested. For each living lab, a

specific implementation model will be developed, depending on the challenges to be tackled.

Ulysseus IHs can be described also as technology transfer interfaces positioned in Ulysseus Community facilitating knowledge transfer and boost of innovation. Ulysseus IHs have their place in the structures of partner universities, while flexibility in the Ulysseus governance structure allows each partner to organise its IH based to its local conditions and environment.

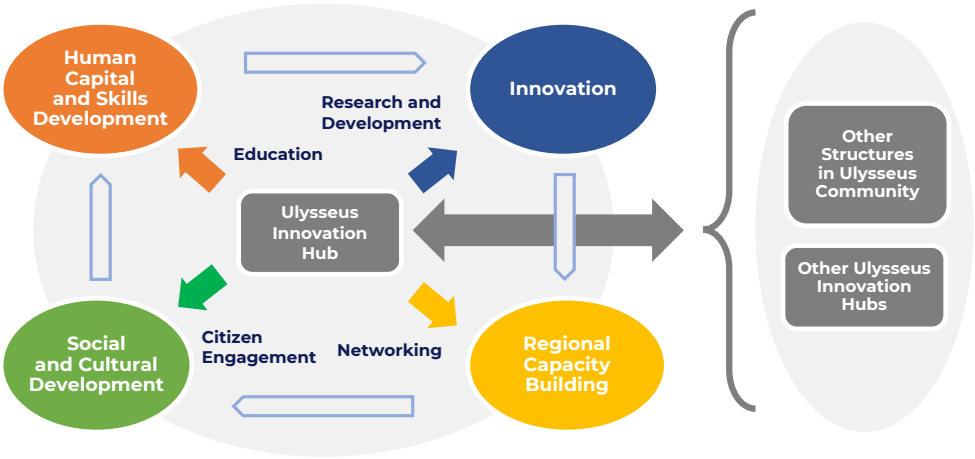

Figure 11 Interactions of Ulysseus Innovation Hub into the local and regional development

In the context of regional development, Ulysseus Innovation Hub interacts in the cycle where thanks to its interventions (in the education, R&D, citizens engagement and networking activities) the areas of innovation, human capital and skills development, social and cultural development and regional capacity building are supported and further developed. Involvement of local and regional stakeholders in this process is very crucial – the Ulysseus Community achieves this through associate partnerships with local and regional government and other key-players. These associate partners do not have only cooperation link to their local partner university but are welcomed and open to cooperate with other partners in the broad the Ulysseus Community (universities, innovation hubs, other associate partners).

Unique combination of components of the Ulysseus Innovation Hubs (joint research centre, incubator, living lab etc.) multiplied by integration in the coordinated and strategically aligned the Ulysseus Community creates a systematic approach on the university level to boost innovation. Connection among all actors in the community is of utmost importance – research teams across partner universities are being connected and stimulated to communicate and work together and share their results in order to create a motivational environment to generate new innovative ideas and solutions. Associate partners are connected and offered collaboration opportunities which might enhance their own operation and strategy.

Understanding the process of technology transfer enables Ulysseus to support

efficiently the creation of innovation. Abundant pile of help and supportive mechanisms for researchers and students who want to develop their ideas in the working project is being systematically and continuously built in the alliance.

Ulysseus Governance Model

As all structures, also Ulysseus European University relies on efficient governance model comprising from following organizational structure incorporating distributed innovation hubs with its organisational structure. Strategic and operational level of the governance model is presented on the Figure .

The Ulysseus is using the **RADAR** as observatory and monitoring progress measure analysing research and innovation trends. The Ulysseus RADAR is the observatory for accurate following up, risk management and necessary adjustments of Ulysseus. It is also the Ulysseus reference structure to observe short- and long-term changes in economy, society, job market and competences. RADAR gathers Universities pedagogical, social, R&I, technological and economic experts know, how to internally evaluate the progress of Ulysseus. RADAR is collecting information from R&I sectors, based on the R&I Agenda, specifically on the Innovation Hubs areas. It creates from RADAR an instrument for foresight and advisory tool for R&I issues. One of the areas of monitoring, will be the fulfilment of relevant KPIs related to ERA policy fulfilment.

This will lead to the identification of challenges and convergences to be competitive in Horizon Europe and other R&I Programmes, as well as to a scheduled plan to gain visibility and positioning of Ulysseus partner Universities in the main international rankings through improving the scientific productivity in the thematic challenge-related areas.

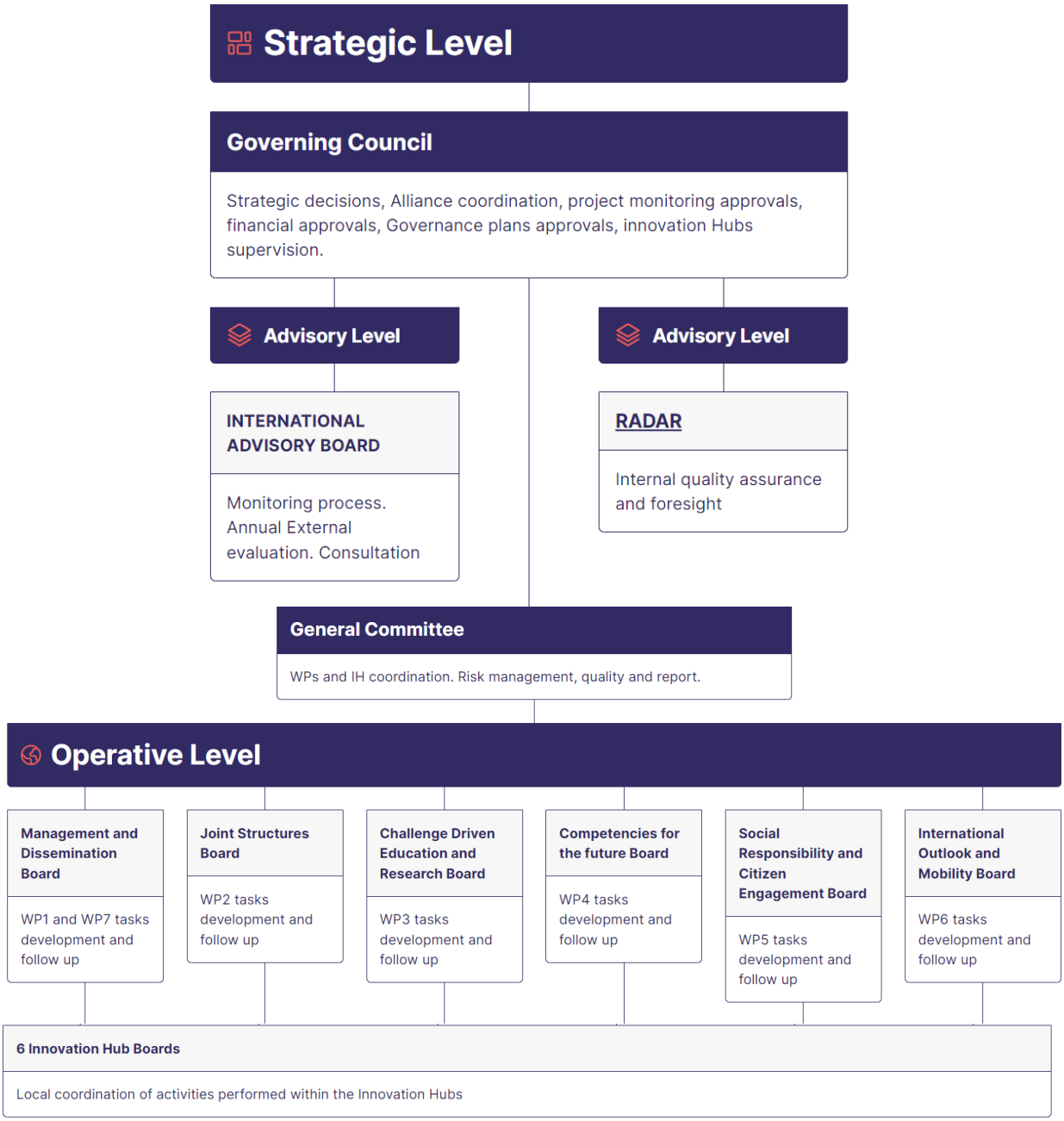

Figure 12 Ulysseus Governance Model (Design Phase, 2020-2023)

Annex 3: Description of Ulysseus Innovation Hubs

The Appendix 1 describes selected Ulysseus Innovation Hubs as they were present in the Design Phase of the Ulysseus European University (2020 – 2023):

- **IH on Sustainable Energy, Transport, Mobility for Smart Cities** (University of Seville) – IH USE
- **IH on Ageing & Wellbeing** (University Côte d'Azur) – IH UniCA
- **IH on Digitalisation** (Technical University of Košice) – IH TUKE
- **IH on Food, Biotechnology & Circular Economy** (MCI Innsbruck) – IH MCI
- **IH on Artificial Intelligence** (Haaga Helia UAS) – IH HH

Note: With the Consolidation Phase of Ulysseus (2023 – 2027) some IHs changed their thematic challenges in order to have them more aligned with the partners' R&I strategies: IH MCI changed the topics from Food, Biotechnology and Circular Economy. Other IHs developed their thematic challenges to be more specific: IH TUKE adjusted the topic from "Digitalisation" to "Digital Transformation of Industry"; IH HH from "Artificial Intelligence" to "Applied Artificial Intelligence for Business & Education".

IH on Sustainable Energy, Transport, Mobility for Smart Cities (University of Seville)

IH on Energy, Transport, Mobility and Smart Cities (IH USE) coordinated by the University of Seville has the main goal of promoting education, research and innovation on efficient and smart energy production and storage, transport, and mobility to build the cities of the future.

The IH USE addresses one of the greatest challenges of the 21st century - the sustainable generation and use of energy to develop a balanced urban model – and aims to provide an interdisciplinary approach to the following key research areas: energy systems, energy for society, smart cities and materials in energy.

In the Design Phase (2020 – 2023) of Ulysseus European University the IH USE followed the same challenge of "Energy, Transport, Mobility and Smart Cities". For the Consolidation Phase (2023 – 2027) the thematic challenge was selected to be more specific.

Legal Structure and Relation to the University

IH USE is part of the Research Foundation of the University of Seville (FIUS), which is a non-profit organization that supports collaboration between companies and entities, public or private, on research projects. These entities seek the knowledge and experience of the teaching staff and the research community of the University of Seville. The fundamental purpose of FIUS is to contribute to the fulfilment of the objectives of the University of Seville, thus improving its capacity to share knowledge, carry out research and provide a comprehensive education.

Organisational structure of IH and responsibilities

IH USE is currently in the process of organizing its Joint Research Centre, which implies, in a first stage, the relocation of several university research groups to the IH premises. In a next step, the Living Lab and the Incubator will be addressed.

The IH USE governance is also common to all the IHs of the consortium and includes an Innovation Hub Manager and a Chief Scientific Officer that are part of the Ulysseus Innovation Hub Committee. The IH works in collaboration with a Scientific Board and a Local Steering Committee (membership in the process of completion), as well as with the Ulysseus Projects Office and several bodies of the university.

Stakeholders Ecosystem

The main 38 stakeholders of IH Sevilla are the Associated Partners, together with whom the University of Seville participates in the Ulysseus consortium. Other stakeholders from the regional innovation ecosystem may be involved in the Ulysseus activities, subject to specific joint projects to be developed.

Startup Ecosystem

The Office for Knowledge Transfer and Entrepreneurship of the University of Seville coordinates 22 active knowledge-based companies (KBS) and 3 that are in the process of incorporation (see the full list here). These companies operate as key instruments for transferring knowledge to the local ecosystem, generating wealth, employment and progress.

Financing and Sustainability

IH USE is financed with the EC funds allocated through the Ulysseus Grant Agreement (through Erasmus+), and with university funds allocated for specific purposes, according to the university regulations.

KPI and Results

A Working Group of Impact Indicators has been established at the University of

Seville, involving staff from both IH USE and other university bodies, and has worked on the definition of a set of impact indicators that the consortium will focus on next figure. These indicators have been associated to the Ulysseus work packages for a targeted approach and include both indicators specified in the Grant Agreement and indicators that the consortium partners introduce for the monitoring and evaluation of their activities. This set of indicators is currently in the process of consultation with the consortium Project Officers and Work package leaders to reach a common understanding of what the indicators refer to, how and when they can be measured.

Future Directions

IH USE, just as all the other IHs of the Ulysseus consortium, operates under a high level of complexity that involves interactions with other bodies of the university, with the other seven consortium partners, and with the local/regional community/ecosystem. At this stage, the mechanisms of collaboration and coordination across all these three levels are still being established and refined, and their proper functioning in the short and long term are key to the success of the consortium. The involvement of other stakeholders from the local innovation ecosystem (business companies, local government, civil society organisations, etc.) is also a critical factor for the success of the consortium and depends on the projects that the consortium will be able to initiate and develop.

IH on Ageing & Wellbeing (University Côte d'Azur)

Objective

The main objective of the IH on Ageing & Wellbeing (IH UniCA) at Université Côte d'Azur is to comprehensively address the challenges of ageing and wellbeing, aligning with Ulysseus domains in formal science, natural science, and social and human science. In the short term, the Hub aims to enhance interdisciplinary collaboration, bridging the gap between research domains and fostering innovative solutions for health promotion, disease prevention, and societal well-being. Long-term goals include advancing the understanding of ageing processes and their implications, with an emphasis on improving healthy life expectancy. The primary domain centres on exploring the biological intricacies of ageing, while complementary domains encompass health data, acceptability, and cohort studies. The Innovation Hub's mission is intricately linked to societal challenges, addressing the economic impact of ageing and striving to improve the overall health and well-being of the population. In alignment with Higher Education (HE) missions, the Hub actively engages in research, education, and collaborative initiatives to promote a holistic approach to societal health challenges.

The IH UniCA is driven by a steadfast motivation to catalyse positive change within

the local and regional ecosystem, as well as to contribute meaningfully to the broader Ulysseus network. Core activities encompass collaborative research initiatives, knowledge exchange, and engagement with local stakeholders.

The IH serves as a dynamic platform for fostering Research and Innovation (R&I) cooperation, involving not only the university's researchers but also extending to related universities, researchers' communities, and students in UniCA. Through targeted programs and initiatives, the Innovation Hub facilitates the seamless transition of basic and applied research outcomes into tangible innovations and their subsequent deployment in the market. By actively involving the research and educational ecosystem, the Hub aims to create a vibrant and sustainable environment that not only advances academic pursuits but also translates cutting-edge research into real-world solutions, fostering innovation and societal impact.

Main Strength

The main strength of the IH lies in its holistic and collaborative approach to ageing and well-being research. What sets it apart in the innovation market, both locally and globally, is its seamless integration of formal science, natural science, and social and human science domains. This multidisciplinary approach fosters a comprehensive understanding of the biological processes of ageing, resulting in innovative solutions that extend beyond traditional silos.

The breakthrough achievement of the Innovation Hub is its successful establishment of the Living Lab, a dynamic environment that facilitates collaboration among citizens, patients, researchers, healthcare professionals, institutions, and companies. This Living Lab allows for real-world experimentation and data collection, enabling the co-creation of solutions and supporting the transformation of research into tangible innovations. The Hub's commitment to involving diverse stakeholders in this collaborative ecosystem is a testament to its impactful contributions to the field of ageing and well-being.

Legal Structure and Relation to the University

IH UniCA is part of the University of Côte d'Azur structure.

Organisational Structure of IH and Responsibilities

- Ulysseus Vice President and IH Coordinator: Stéphane Ngo Mai
- Innovation Hub Manager: currently recruiting
- Head of the living lab: David Darmon
- Living Lab Coordinator: Francine Bastiment
- Living Lab manager: Laurie Testut

IH UniCA comprises from the following elements:

- *Living Lab* as a dynamic space - a collaborative environment for sharing knowledge, technologies, and discussions on the societal challenges of tomorrow. It provides unique conditions for research and experimentation. A Living Lab is a place in which citizens, residents, and users are considered key actors in the research and innovation processes. It brings together public and private entities, businesses, associations, and individual actors with the goal of testing new services, tools, or practices in a real-world context. The aim is to move research out of laboratories and integrate it into everyday life. This occurs through collaboration between local communities, businesses, research laboratories, and potential users. The Ulysseus Living Lab at the University Côte d'Azur has a network of over 400 partnering healthcare professionals and more than 60 patient representatives.

- *The Learning Lab*: is the component dedicated to training and education within the Innovation Hub. Learning Labs are places for experimenting with educational innovation, often supported by businesses or groups of universities, and training centres, aligning with the trends of MOOCs, collective intelligence, and the web 2.0. The objective of the Learning Lab is to boost creativity by promoting collaboration, communication, and conviviality.

- *The incubator*: The Innovation Hub will also play the role of an incubator. In addition to fostering innovation and the development of new solutions, the IH aims to support local students and entrepreneurs in their entrepreneurial endeavours, addressing financial, administrative, and technological aspects. As an incubator, the Innovation Hub provides startup leaders with offices and a variety of services to assist them in their development. Companies based at 27 Rue du Professeur Delvalle, Nice, France, will have the opportunity to utilize the Living Lab to experiment with their prototypes or ideas, leverage research conducted in the Learning Lab to advance their projects, and access data from the Data Center.

- *The Data Center*: aims to collect and centralize medical patient data to identify trends or risky behaviours within specific segments of the population.

Stakeholders Ecosystem

The stakeholders ecosystem of the IH UniCA is diverse and collaborative, involving academic researchers, local healthcare professionals, institutions, citizens, and private companies as the IMREDD, CNRS, CIUS, CI3P, and DERMG...etc. Academic stakeholders contribute to core research activities, while healthcare professionals and institutions provide real-world insights. Citizens actively participate in Living Lab initiatives, offering valuable feedback. Private companies, especially start-ups within the Hub, aid in translating research into market-ready innovations. Beyond the local context, Ulysseus serves as a strategic partner, fostering collaboration with other

universities. Government bodies and policymakers are also essential stakeholders, influencing the regulatory landscape. This inclusive approach ensures a holistic and impactful response to societal challenges related to ageing and well-being.

Startup Ecosystem

The Kokoon, developed by the start-up Nodeus Solutions et Indienov, is an innovative predictive teleassistance solution that has found its home within our Innovation Hub "Ageing and Well-being" at Université Côte d'Azur. This young company has created a patented, groundbreaking device that connects isolated elderly individuals at home with their community. Without using a camera or microphone, the Kokoon records daily signals, analysing the behaviour of seniors. It establishes an essential connection between isolated individuals and their social circle or healthcare professionals, creating an atmosphere of "inclusive and supportive care."

Nodeus Solutions, based in the south of France, has patented this revolutionary solution, which will be showcased at CES in Las Vegas this month in partnership with the Sud Region. The Kokoon stands out for its easy installation, transforming any living space into a smart residence in just 40 minutes, without the need for construction work. On a daily basis, it ensures real-time communication with family caregivers and healthcare professionals, alerting them to early signs of frailty or loss of autonomy. It is also noteworthy that the 24/7 supervision service is provided by the teams of the NS Citadelle adapted and handicapped insertion company, present both in the mainland and overseas territories. Kokoon's contribution to improving the well-being of the elderly is a concrete example of the positive impact our Innovation Hub aims to generate in society.

Besides, IH UniCA incubated the startup INFINEIS, which has developed a medical device tailored to each patient, streamlining and securing intracranial surgeries. The system holds significant potential in human applications for treating brain tumours and, among other uses, addressing hearing impairment. Additionally, the device is applicable to veterinary surgery.

Financing and Sustainability

The IH UniCA's financing is derived from a multifaceted approach, embodying a diverse and sustainable funding model. A substantial portion of the funding is attributed to support from Ulysseus, underscoring a dedicated commitment to the Hub's objectives within the academic institution. Additionally, the Innovation Hub secures funding from the French government and locally from IDEX UniCAJEDI. This collaborative financial strategy not only ensures the Hub's operational sustainability but also reinforces its capacity to pursue innovative research initiatives and address challenges related to ageing and well-being.

KPI and Results

Improvements and results within the Innovation Hub at Université Côte d'Azur are gauged through a robust set of Key Performance Indicators (KPIs). These indicators include collaborative research progress, successful transitions to market, and community engagement levels. Quantitative metrics like publications, patents, and grant success rates offer tangible measures of academic and innovative output. Qualitative assessments, incorporating stakeholder feedback and societal impact evaluations, provide additional insights. Regular evaluations ensure a comprehensive understanding of the Hub's performance, facilitating ongoing adjustments to meet the evolving challenges in ageing and well-being research.

Future Directions

Future visions and directions of IH in short and long term. What is planned to improve and is considered as crucial success factor to be leading IH in the regional/national/EU innovation market.

The IH UniCA envisions a dynamic future characterized by both short and long-term initiatives. In the short term, the Hub aims to bolster collaborative research, intensify industry partnerships, and further engage with local communities through the Living Lab. Long-term objectives include advancing interdisciplinary research on ageing, expanding international collaborations within the Ulysseus network, and driving innovation to address societal challenges. Crucial to its success is a strategic focus on sustainability, both in terms of funding models and the ethical use of emerging technologies. Embracing a people-centric approach, the Hub plans to strengthen connections between citizens, researchers, and businesses, placing societal impact at the core of its initiatives. By fostering a culture of innovation, adaptability, and global collaboration, the Innovation Hub aspires to position itself as a leading force in the regional, national, and European innovation landscape.

IH on Digital Transformation of Industry (Technical University of Košice)

Vision & Objectives

The IH on Digital Transformation of Industry (IH TUKE) at Technical University of Kosice (TUKE) aims to facilitate digital transformation in various industry segments, aligning with regional research priorities and addressing European challenges. Main vision is to increase the societal impact and international recognition of TUKE and Ulysseus European University through breakthrough innovations in the field of digital transformation that can solve industrial and societal problems by connecting excellent R&I infrastructure and ecosystem and quality education.

Among its objectives are primarily:

- Strengthen internationalization in the field of research and innovation activities,
- Improve the quality of interdisciplinary research and technology transfer in the field of digital transformation,
- Strengthen cooperation within the Ulysseus ecosystem,
- Develop a systematic approach to innovation and support rapid innovation,
- Strengthen the visibility of R&I results and their impact,
- To develop groundbreaking R&I to solve societal needs.

The activities that IH TUKE intends to focus on include the physical implementation of the Innovation Hub, engagement with research teams and stakeholders, facilitation of start-up/spin-off incubators, support for R&I projects, identification of living labs, utilization of tools to enhance the visibility of R&I results and researchers, systemic support for the development of breakthrough ideas, educational activities, and synergies with the ecosystem such as EDIHs, EEN, or EIT.

Basic Description

Situated within the University Science Park TECHNICOM at TUKE, the hub serves as an interface between internal university potential (including teachers, students, researchers), regional innovation ecosystems (industry, research, NGOs, authorities including Ulysseus associated partners), and the Ulysseus campus. It actively participates in entrepreneurship acceleration initiatives, collaborates with startup incubators, and plays a crucial role in developing the regional European Digital Innovation Hub (EDIH).

Main Strength

A notable strength of the hub lies in its integration within the university's ecosystem and its ability to leverage regional partnerships. By fostering collaboration among diverse stakeholders, the hub creates synergies that drive impactful digital transformation initiatives. One of the significant ties is with the Ulysseus associated partner, Košice IT Valley, which gathers hundreds of companies in the field of digitalization. Among them are several key industrial partners (world-renowned IT companies) with whom real collaboration is ongoing, and this partnership is strategic for both parties. This implies a high level of engagement from the local ecosystem to work on IH goals and their actual achievement.

Stakeholders Ecosystem

The IH engages with diverse stakeholders, including university researchers, R&D laboratories, regional authorities, industry partners, and other universities and clusters in the region, fostering these relationships through long-term collaborations and the university's engagement with the local ecosystem. Some of the key local players are

already the Ulysseus associated partners engaged in the Ulysseus Campus. It fosters collaboration and knowledge exchange among these stakeholders to drive digital transformation initiatives.

Startup Ecosystem

Participating in activities of Startup TUKE and Incubator TUKE, the hub contributes to Slovakia's vibrant startup ecosystem. It provides support to entrepreneurs, facilitates access to resources, and nurtures innovative ideas to fruition. The Startup Center TUKE plays a significant role not only within the region but even at the national level. It consistently and systematically identifies and supports early-stage startups, while the TUKE Incubator provides a conducive environment for more advanced firms aspiring to launch innovative services or products into the market. Such startups include, for example, Nordics.io, StorePredictor, Smart City Group, CeeLabs, and Pulsawork.

Financing and Sustainability

The main financial sustainability relies on grant sources from the Ulysseus project to catalyse the ecosystem in the field of digitalization, which is interconnected with many key stakeholders. Among them are private companies or relevant ministries and authorities, which, in the case of high visibility of IH and successful demonstration of activities, can provide direct sponsorship or funding for IH operations. Another option will be the continuous search for additional grant schemes that strategically support the activities conducted by IH TUKE.

KPI and Results

Key performance indicators (KPIs) include the number of successful startups incubated, the amount of external funding secured, and the impact of digital transformation initiatives on regional industries. Results are measured through innovation metrics, economic indicators, and stakeholder feedback. Additionally, the outcomes of the Innovation Hub encompass the physical establishment and local visibility within the TUKE campus, general visibility within the local ecosystem, and the integration of existing or new living labs. The co-creation of a knowledge platform through the development of R&I themes and groups serves as support for further activities within the Ulysseus European University. Collaboration with satellite projects to establish a joint business incubator, co-development of a joint study program, and other outputs contributing to Ulysseus's strategic objectives also fall under the outcomes of the Innovation Hub.

Future Directions

Looking forward, the hub endeavours to broaden its impact and reinforce its position as a driving force for digital innovation. Its future direction involves expanding

successful initiatives, fostering new collaborations, and aligning with emerging trends in digital transformation.

The IH TUKE is committed to facilitating digital transformation across diverse industry sectors, in alignment with regional research priorities and European challenges. Its overarching vision is to elevate the societal influence and global standing of TUKE and Ulysseus European University by catalysing breakthrough innovations in digital transformation. These innovations aim to tackle industrial and societal challenges by leveraging robust R&I infrastructure and ecosystem while delivering high-quality education.

IH on Artificial Intelligence (Haaga Helia UAS)

Objective and Domain

Haaga-Helia's Innovation Hub on Artificial Intelligence (IH HH) concentrates on the application of AI opportunities across many domains. Specifically, the application of AI tools and methods will be studied and implemented in a wide array of contexts related to business and education. Through the IH, Haaga-Helia will endeavour to promote the application of AI tools and methods to meet the challenges presented by this advancing technology. To achieve this, Haaga-Helia will leverage its extensive synergies in the world of work and business and provide the platform to support researchers and teachers to identify synergies and skill mismatches in the labour market. The IH's core strength is its applied relationship through an extensive regional innovation ecosystem consisting of SMEs eager to learn and adapt to the growing use of AI and lead to future economic growth.

Legal structure and relation to the University

The AI Innovation Hub is a part of Haaga-Helia UAS and has a strategic role in the actions of the University.

Organisational structure of IH and responsibilities

The basic organizational structure is the same for all IHs, where William O'Gorman is the Innovation Hub Manager and Timo Kaski, as a research area director at Haaga-Helia is Chief Scientific Officer of Innovation Hub.

IH on Food, Biotechnology & Circular Economy (MCI Innsbruck)

Objective and Domain

The IH on Food, Biotechnology & Circular Economy (IH MCI) aimed at transferring knowledge, building up competences, and fostering social responsibility and citizen engagement for Europe and beyond.

The IH MCI addressed the following topics: sustainable and safe food production, natural resources in agricultural and marine environments, bio-based raw material biodegradation for a sustainable circular economy, bio economical aspects. These topics are highly relevant to tackle challenges and effects induced by global climate change. They are particularly fundamental topics given the goals of Europe to become the first climate-neutral continent in 2050.

Basic Description

In order to foster research and development activities within Ulysseus, the MCI Innovation Hub organised the Ulysseus Summer School on food, biotechnology & circular economy. Advanced students (around 90) were invited to take part in the summer school to learn about the latest developments in the fields of food, biotechnology & circular economy. The program consisted of scientific presentations provided by invited researchers of all involved institutions and of career workshops with graduates and industry experts. In connection to the summer school, Ulysseus researchers as well as researchers from other institutions working in the fields of food technology, agricultural sciences, biosciences, biotechnology, and circular economy, were invited to foster exchanges and get-together activities in order to build and strengthen future educational collaborations and research activities within and beyond the Ulysseus Alliance. Researchers were able to connect via a dedicated workshop during which they could explore collaborations in forthcoming Horizon Europe calls. They were encouraged to create new consortium and to investigate the possibility of developing joint study programs in the relevant fields. This event successfully set a first important cornerstone in the activities of the Innovation Hub Food, Biotechnology & Circular Economy at MCI. A concrete result of this workshop was an Horizon Europe proposal on aquaculture and sea urchins. This proposal gathered researchers from the Ulysseus partners as well as researchers from other institutions met during the workshop/summer school. Although eventually not granted, the proposal submitted by the consortium enable the participating researchers to draw on a wealth of experience for the upcoming challenges and calls for proposals.

Another direct result of the Innovation Hub activities was the development of an Ulysseus Joint Master Degree in the field of “Sustainable Management in Life Science and Engineering” which is currently being coordinated by MCI. This Joint Master

aims at providing European and international students with a state-of-the-art education in this field in the upcoming years. In a very active and co-creative exchange, all Ulysseus partner universities contribute to the development of this Master's programme based on jointly agreed principles and guidelines. In addition, two Ulysseus Double Master Degrees were set up between MCI and USE and between MCI and UNIGE connected to the Innovation Hub topics to foster Challenge-driven Education, Research and Transfer of Knowledge.

The MCI Innovation Hub also contributed to the Ulysseus MOOC on Sustainable Development with content and expertise. The Innovation Hub together with the MCI Learning Solutions Department were fundamentally involved in the process. Furthermore, the MCI Innovation Hub was strongly involved in co-creating an Open-Class-Sites Concept.

Finally, two public Ulysseus Webinars on "Circular Economy and opportunities for the Green Deal" and on “Industrial Sustainability: Challenges, Perspectives, Actions” involving stakeholders and researchers were organised by the MCI Innovation Hub.

Legal structure and relation to the University

The Innovation Hub at MCI did not have any specific legal structure and was directly integrated within the relevant department at the MCI (Biotechnology Department).

Organisational structure of IH and responsibilities

The MCI Innovation Hub on “Food, Biotechnology & Circular Economy” was composed of an Innovation Hub Coordinator and an Innovation Hub Manager. Regular meetings were organised by the Innovation Hub Board. The role of the Innovation Coordinator consisted in implementing the mission statement of Ulysseus. The coordinator was also in charge of relationships with stakeholders. The Innovation Officer tasks consisted in defining, implementing and managing the Innovation Hub activities. The Innovation Hub board was in charge of the scientific strategy of the Hub. It was composed of the Innovation Hub Coordinator, the Innovation Hub Officer, MCI researchers, students and local stakeholders. The board was also in charge of managing calls for project internal to the Ulysseus Alliance.

Stakeholders Ecosystem

The MCI Innovation Hub benefited from the support of many local stakeholders and associated partners bringing in their expertise. Stakeholders range from the regional government, the city hall, local NGOs, think tanks, business associations to private companies. A number of meetings were organised by the Innovation Hub and local stakeholder to share expertise and strategic insights.

As the goal of the Innovation Hub was to embed regional stakeholders into a

comprehensive innovation ecosystem, 27 stakeholders could be integrated into a regional network (and beyond). Stakeholders could also be involved in joint projects in the future. The MCI Innovation Hub aimed at connecting public and private stakeholders and MCI researchers. Thus, communication strategies included frequent face-to-face Innovation Board meetings, where all Innovation Hub relevant departments, as well as stakeholders and student representatives were actively contributing to shaping the MCI Innovation Hub Ecosystem. Bilateral, online or face-to-face meetings were held to recruit and involve both stakeholders and researchers from our region and from abroad. The MCI actively promoted the Hub activities via newsletter and external channels such as social media and magazines.

Financing and Sustainability

In terms of financing, the Innovation Hub relied on the MCI internal resources, as well as the Ulysseus budget and third-parties funding (i.e., satellite projects).

KPI and Results

KPIs were the following: number of patents (quantitative), number of licensed patents (quantitative), number of contracts with business (quantitative), number of spin-offs (quantitative), national or regional funds raised capital, number of joint ISI publications (quantitative), living labs visits (quantitative), number of joint structures.

The biggest achievement of the MCI Innovation Hub was the creation of a blueprint for building consortium for European calls for proposal amongst the Ulysseus partners. The researcher workshop described below was the starting point for creating such a blueprint which now used amongst Ulysseus partners to connect researchers within Ulysseus as well as outside Ulysseus.

Future Directions

For the second phase of Ulysseus, the MCI further developed its Innovation Hub toward the topic of entrepreneurship, a core competence of the MCI. The purpose was to reinforce the connection between the different departments through a topic common to all in order to better support research and innovation. The initial topics (food, biotechnology and circular economy) are still covered and core to the Hub, but will benefit, in the future, from such transversal approach. The “re-focus” also allowed for the inclusion of a broader spectrum of local stakeholders. Thus, the MCI is now hosting the Innovation Hub on “Sustainable Entrepreneurship & Impact”. The MCI Innovation Hub is focusing on the acceleration of technological business models by exploiting established structures, integrating partner services of the regional ecosystem and creating new formats and structures. The Sustainable Entrepreneurship & Impact Hub will MCI contribute to the competitiveness of the Tyrol region, but also to that of its European partners and the European Union itself.

Annex 4: ERA Related Use-cases of Ulysseus Innovation Hubs

This annex brings mor details on use-cases collected within the Ulysseus European University. These are good practice examples for those, who are planning and establishing Innovation Hubs with its ERA Hub relevant infrastructure.

The presented use cases describe also lessons learnt in the core areas of ERA Hub which are Living labs approach development around Innovation Hubs together with new approaches for training and education, like open classes or other models.

Living labs and research groups

Living Lab (IH UniCA)

ERAH Pillar/Objectives: The objective of this use case is to promote healthy ageing, advance interdisciplinary research, foster innovation, and enhance societal well-being.	
IDs ERAH measures: • Promotion of healthy ageing through interdisciplinary research and innovation. • Development and implementation of solutions for addressing the challenges of ageing populations. • Engagement with stakeholders to ensure relevance and societal impact of research initiatives. • - Integration of data-driven approaches and technologies to inform research and innovation in healthy ageing.	
Key words/tags: Ageing, Well-being, interdisciplinary research, innovation, stakeholder engagement, data-driven approaches, technologies.	
Coverage: • Local/national: The use case primarily focuses on addressing local and national challenges related to healthy ageing within the community served by the Innovation Hub on Ageing and Well-being at Université Côte d'Azur in Nice, France. • Ulysseus/Global: The outcomes have also the potential for broader application and impact within the Ulysseus alliance.	
Description & objectives	The Living Lab established within the Innovation Hub on Ageing and Well-being at Université Côte d'Azur serves as a dynamic platform for fostering interdisciplinary collaboration and innovation in the field of healthy ageing. The main objective is to address the complex challenges of ageing populations by co-creating and testing innovative interventions. By engaging researchers, healthcare professionals, technology experts, and community members, the Living Lab aims to develop solutions that enhance well-being, prevent diseases, and improve quality of life. The use case aligns with strategic goals at the university, national, and European Commission levels, contributing to the advancement of knowledge, innovation, and societal well-being.

The history of the use case	The motivation for establishing the Living Lab stemmed from a recognition of the need for interdisciplinary collaboration to address the challenges of healthy ageing in the region of Nice / Côte d'Azur. Demographic trends, healthcare system overload, and economic impacts highlighted the urgency of developing innovative solutions. Expectations were set to co-create interventions that promote health, prevent diseases, and enhance well-being among ageing populations, ultimately improving healthy life expectancy and reducing dependency-related spending.
Resources	Successful implementation required funding from research institutions, government agencies, and potentially private sector partnerships. Human resources included researchers, healthcare professionals, technology experts, and administrative staff. Sustainability was ensured through diversified funding streams, ongoing training, and collaboration networks.
Planning & Realization	Preparation involved extensive research, formulation of action plans, and coordination of stakeholders. Challenges such as logistical hurdles and resource constraints were addressed through proactive problem-solving strategies. Implementation involved coordination of interdisciplinary teams and stakeholder engagement. Key success factors included effective planning, problem-solving, and collaboration. In addition to its internal operations, the Living Lab at Ulysseus has established fruitful collaborations with external organizations, including the *Institut Méditerranéen du Risque de l'Environnement et du Développement Durable* (IMREDD) of Université Côte d'Azur. This collaboration leverages the expertise of both entities to address pressing challenges related to environmental sustainability, risk management, and sustainable development. By joining forces, the Living Lab and IMREDD aim to drive innovation and develop practical solutions that contribute to the well-being of communities and the preservation of the environment. Through this partnership, they exchange knowledge, share resources, and coordinate research efforts to achieve common goals.
Results	The Living Lab achieved significant outcomes, including the development of novel interventions, generation of new knowledge, and translation of research findings into real-world applications. Monitoring measures facilitated evidence-based decision-making and optimization of resources. Synergy with the Ulysseus ecosystem offered broader applicability and impact.
Lessons learnt	Strengths included successful interdisciplinary collaboration, stakeholder engagement, innovation, and continuous improvement. Weaknesses included resource constraints and communication challenges. Critical success factors included leadership, stakeholder engagement, adaptability, and continuous learning. This Living Lab use case demonstrates excellence in promoting healthy ageing through interdisciplinary research and innovation, contributing significantly to ERAH objectives and R&I performance.

Internationalisation of Research Groups and Researchers Networking/brokerage Support (IH TUKE)

ERAH Pillar/Objectives 7 Science quality, incl. international scientific collaboration	
IDs ERAH measures: International research group management	
Key words/tags: research groups, international, science, participation	
Coverage: Ulysseus global	
Readiness level: Ongoing	
Description & objectives	The objective of this measure is to support researchers within different Ulysseus universities and stakeholders to establish better international connections with researchers from other universities, to establish international research group within Ulysseus ecosystem (U-RG) and to achieve higher quality scientific results and impact. Together, the objective is to establish or enhance living lab in this international research environment to reach wider international recognition and potential R&I results adoption by the world of practice. The process of international research group establishment is two dimensional. One dimension is informal, using Ulysseus platforms, tools or services to find researchers with the interest to collaborate in similar domain or in requested expertise. Another one, is formal, where Ulysseus Alliance incorporates its structures and horizontal services to support creation, management, and impact achievement of this research group. It is based on international efforts of Ulysseus Alliance to ERA Hub transformation and HEI of new generation. The process is supervised by Innovation Hub (IH), which was established in each Ulysseus partner university. Innovation Hub is formal and official office with its own structures - Innovation Hub manager, Innovation Hub Chief Scientific Officer and steering committee. After selection of formal Ulysseus Research Group, the RG will achieve full support of relevant Ulysseus support services like increased promotion and visibility, project proposal submission support, specific digital platform provision, open repository management and other R&I related services to increase quality of R&I results and its impact. IH in cooperation with U-RG has to monitor and report KPIs to assess progress and societal impact.
The history of the use case	The main motivation for international RG creation lies behind researchers' motivation to increase their impact and recognition in the global R&I environment. The first attempts were informal, through contacting Ulysseus IH responsible persons to help vision holder with dissemination of his brokerage/networking request to find relevant researchers. This informal model was nice example of involvement of international Ulysseus structures to help researchers from Ulysseus ecosystem to find research mates and to cooperate in international environment. The results shown that searching and dissemination is quite difficult as each IH had own strategy to disseminate and search suitable research partners with different results. Parallelly, Ulysseus community applied for additional project to support visions and plans, where also joint research action was the objective. Within the first meetings, several strategies were obtained from

	researchers and IHs representatives based on previous experiences. Several strategies were then proposed, applied and tested. Although, this initiative/action is in progress, several partial efforts or actions funded by Compass project were implemented and tested. Ulysseus strategies were discussed on relevant workshops/meetings and prepared to be applied within Ulysseus ecosystem. 2024 is the year when all proposed strategies are already or being implemented and assessed.
Resources	As this action is multidimensional and relates to several project funding and in house actions achieved by in house resources of Ulysseus partner university, the success lies in multi-source funding. The sustainability of the model is ensured by each IH based on their strategy. TUKE IH is based on mentioned multi-source public and in-house funding and by additional (incl. private) funding achieved from successful RG results implementation (project proposal submission into different R&D programmes or private funding).
Planning & Realization	To prepare this action/measure, IHs had to establish its organisational structure in formal way, where steering committee was crucial. Members of steering committee were selected from stakeholders and from other Ulysseus IHs to be able to provide support and interconnection with the research community on their university. First, several strategies for suitable researchers for U-RG identification were prepared or is in progress. • One was based on the questionnaire survey of research interests and researcher profile. This questionnaire is disseminated across each Ulysseus university and asked researcher to fill requested information. The main strength is the possibility to provide also information about new research interest, which are not extractable from existing R&I results. Together, information are structured and easily mapped or processed. The weaknesses are the presumption, that all researchers are motivated to fill the questionnaire and classification of R&I domains, which are selectable by researcher. • Another approach was the use of newest AI technologies esp. LLM models, utilising open science (full papers) and accessible information on publications (title and abstracts) tested within Compass project to provide seamless and flexible tool to identify researchers, research teams realising similar research, relevant domains or implementing and developing interesting methodology. This approach already tested is planned to be open to all researchers not only within Ulysseus ecosystem but also for third or external partners and researchers looking for cooperation within Ulysseus ecosystem. The strong aspect of this tool is the scalability also for other purposes like monitoring international publication progress or incorporating this tool to industrial and public actors looking for skilled and trusted researchers or international research teams able to develop or provide innovative solution or service within R&I sourcing tasks. o Specific approach of this AI driven networking tool is focused on tool for IH representatives in the process of searching suitable researchers for RGs presented by

	vision holder. This approach seems to be more trusted and successful, as IH representatives are more recognized and trusted by their university members as in the case of direct communication by vision holder. • Informal searches for researchers to cooperate with vision holder are also supported and welcome to enhance international scientific cooperation. In this case, the challenge is monitoring research cooperation and results what is responsibility of vision holder. The strategy for the RG management process lies in following points: • IH organises meetings for selection of research groups based on the presentation of vision holder, who is interested in U-RG creation. • IH with its steering committee and support of other Ulysseus IHs are assessing the research topics and perspectives of RGs. • The objective of U-RG (assessed) is stated as: The improvement of research quality and impact through internationalisation of research groups within Ulysseus ecosystem" with long (1+y) and short (1y) term approach. • Specific objectives of RG establishment (assessed) are stated as: o Improvement of research methodology of RG's vision holder o Data sharing and building global data warehouses o Breakthrough research/innovation results o High Quality Scientific papers publishing o Horizon Europe projects submission & coordination o Synergy for national projects o Increase global impact and societal value – innovation deployment o Promotion of sound R&I results of Ulysseus o Improving education and students' involvement o Synergy with U-research and innovation strategy • The process of RG's selection is based on IH steering board decision. RG management is under responsibility of RG's vision holder who is responsible for international research tasks management and KPIs monitoring and reporting to the relevant IH. Within the process of strategy implementation, several open issues emerged: • Stakeholders from steering committee must have wider scope and be able to assess and understand wide scale of research and innovation problems around IH's domain (e.g. TUKE IH – Digital Transformation) what can be challenging. • Identification of suitable researchers with potential interest to join research group with its research topic and problems can be also challenging if university of IH doesn't have quality dissemination channels. • Description of research group's topic with concrete research problems definition is crucial to be able to understand potential research cooperation. • Implementation of AI or data driven tools can be beneficial not only for researchers but also for IH representatives, who can open trusted connection to relevant researchers within their university with higher success then in the case, when vision holder is contacting identified researchers himself.

	One specific open issue emerged within one RG, where sensitive and open data are used for innovative solution creation. In the case of scientific or project proposal submission objectives of RG, there is usually joint awareness and understanding easier. In the case of innovation action, esp. in the cases of data services development, it is suitable to agree code of conduct or specific NDA implementation for all members of international RG to avoid unfair practices or undesirable behaviour. Code of conduct should be formulated for the data manipulation purposes as well as using data and knowledge generated within specific RG to external activities, esp. with potential to commercialisation or EU project proposal submission. Code of conduct will increase trust between members and make joint understanding and research efforts more easier.
Results	This strategies except questionnaire survey were already applied within TUKE IH in 2024 to enhance Transactional Data Living Lab for AI driven Supply Chain Management and to create R&I sourcing and networking AI service. – Testing KPI were set up as numbers of researchers identified and number of RGs presented and established. In one case of RG, IHs were able to identify 8 researchers, although applying AI R&I networking tool additional 15 suitable researchers were identified and two subgroups for main RG were established. – In one specific RG, the research work is already in progress enhancing living lab results and data warehouse. One significant shift is visible in diverse progressive AI technologies application increasing robustness of research methodologies. – Additional 4 RGs in IH TUKE were identified and established as a result of strategy implementation.
Lessons learnt	During preliminary RG strategy implementation, several critical success factors were identified: • Identification of suitable researchers from other universities and countries is more efficient by using AI service esp. because of non-mandatory process for profiling researchers. Together, very efficient is flexibility of AI search service results providing possibilities to identify non-expected researchers with potential to enhance R&I results of vision holder and to provide analysis on R&I results progress within Ulysseus ecosystem. • IH's steering group should contain members of other IHs and stakeholders with wider innovation focus within IH's domain. • RGs are in progress and final results can be assessed after one year or longer. That's why interim reporting and assessment is suitable. • University management has to be strongly involved and dedicated to aligning RG strategy with university vision, objectives and R&I strategy. • RGs are suitable to be implemented also into the educational processes by incorporating students activities into RG tasks. • Code of conduct within RG kick off meeting should be proposed and agreed.

Research Infrastructure for the Era of Data Economy and AI Hype

Data Center (IH UniCA)

ERAH Pillar/Objectives: Pillar: Research Infrastructure Enhancement Objectives: Centralization and Analysis of Patient Medical Data	
IDs ERAH measures: Strengthening Research Infrastructure Enhancing Data Collection and Analysis Capabilities-Research efficiency	
Key words/tags: Data Center, Medical Data, Patient Records, Centralization, Analysis, Trends, Risk Identification	
Coverage: • Local/national: The use case primarily focuses on addressing local and national challenges related to healthy ageing within the community served by the Innovation Hub on Ageing and Well-being at Université Côte d'Azur in Nice, France. • Ulysseus/Global: The outcomes have also the potential for broader application and impact within the Ulysseus alliance	
Description & objectives	The Data Center initiative aims to collect and centralize patient medical data to facilitate the identification of trends or risky behaviours among specific segments of the population. By consolidating medical records from various sources, the objective is to create a comprehensive database that enables researchers to analyse health-related patterns, outcomes, and potential risk factors. The primary goal is to enhance research capabilities in understanding and addressing public health challenges by leveraging data-driven insights derived from extensive patient information.
The history of the use case	The motivation behind establishing the Data Center stemmed from the need to streamline medical data management and analysis processes in the Ulysseus Living Lab. Recognizing the fragmented nature of patient records across healthcare systems, the initiative sought to address this challenge by centralizing data resources. The expectation was to improve research efficiency, promote interdisciplinary collaboration, and ultimately advance healthcare outcomes through evidence-based practices.
Resources	The successful implementation of the Data Center relied on adequate funding for infrastructure development, data integration technologies, and skilled personnel for data management and analysis. Sustainability is ensured through ongoing investment in technology upgrades, data security measures, and workforce training to adapt to evolving research needs and regulatory requirements.
Planning & Realisation	As part of the Ulysseus living lab activities, the realization phase involved meticulous planning to establish data collection protocols, ensure data privacy and security compliance, and implement robust data analysis frameworks. Challenges such as data interoperability, quality assurance, and stakeholder engagement were addressed through strategic partnerships, stakeholder consultations, and iterative process improvements.

Results	The Data Center has facilitated the consolidation of vast amounts of patient medical data, enabling researchers to uncover valuable insights into disease prevalence, treatment effectiveness, and population health trends. Monitoring measures, including key performance indicators (KPIs), have demonstrated increased research productivity, enhanced data accessibility, and improved collaboration among healthcare stakeholders. The initiative has also showcased potential synergies for the Ulysseus ecosystem by offering data-sharing opportunities and fostering interdisciplinary research collaborations.
Lessons learnt	The Data Center initiative aligns with Ulysseus' strategic objectives of enhancing research infrastructure and promoting data-driven innovation. By centralizing patient medical data within the Ulysseus Living Lab strategy, the initiative contributes to the creation of a comprehensive research ecosystem that supports collaborative research efforts and accelerates scientific discoveries. Synergies with other Ulysseus or UniCA's initiatives, such as Match4Coop and open science initiatives, further amplify the impact of the Data Center on advancing research excellence and addressing societal challenges. Furthermore, the establishment of the Data Center not only strengthens Ulysseus' position as a key player in the global R&I ecosystem but also sets a precedent for how ERA hubs can be developed to foster cross-disciplinary collaboration and drive innovation on an international scale.

Fostering Innovation

Incubator (IH UniCA)

ERAH Pillar/Objectives: Pillar: Innovation Ecosystem Development Objectives: Fostering Research and Entrepreneurship through Incubation	
IDs ERAH measures: Promoting Innovation and Entrepreneurship Supporting Research-Industry Collaboration	
Key words/tags: Innovation Incubator, Entrepreneurship, Research Commercialization, Startups, Collaboration, Incubation Support	
Coverage: Local/national	
Description & objectives	The Ulysseus Incubator at Université Côte d'Azur serves as a catalyst for fostering research-driven entrepreneurship and accelerating the commercialization of innovative ideas. With a focus on supporting early-stage startups and researchers, the Incubator provides a nurturing environment where innovative concepts can evolve into viable business ventures. The primary objectives include providing incubation support services, facilitating access to funding opportunities, fostering collaboration between academia and industry, and nurturing a

	culture of innovation and entrepreneurship within the Université Côte d'Azur ecosystem.
The history of the use case	The establishment of the Innovation Incubator stemmed from the recognition of the need to bridge the gap between research outcomes and market-ready products or services. By providing dedicated support and resources to aspiring entrepreneurs and researchers, the initiative aimed to translate intellectual property and research findings into tangible solutions with commercial potential. The Incubator's inception was driven by the desire to foster a vibrant innovation ecosystem capable of driving economic growth and societal impact through entrepreneurship within the Ulysseus Alliance.
Resources	The successful operation of the Ulysseus Incubator required a blend of financial investment, infrastructure development, and expertise in entrepreneurship and business development. Funding was allocated for the establishment of physical infrastructure, staffing, mentorship programs, and seed funding for start-ups. Sustainability is ensured through revenue streams generated from successful start-up exits, partnerships with industry stakeholders, and ongoing support from the university and government initiatives.
Planning&Realization	The planning and realization phase of the Innovation Incubator involved strategic collaboration with startups like Nodeus Solutions and Indienov, who developed the Kokoon teleassistance solution. Through partnerships with these innovative ventures, the Incubator facilitated the integration of groundbreaking technologies into real-world applications aimed at addressing societal challenges. Key activities included providing access to prototyping facilities, facilitating regulatory compliance, and offering mentorship on market validation and business model development. The Kokoon, a revolutionary predictive teleassistance solution, underwent rigorous testing and validation within the Innovation Hub "Ageing and Well-being" at Université Côte d'Azur. Nodeus Solutions, in collaboration with Indienov, leveraged the resources and support provided by the Incubator to refine their product and prepare for market entry. The Incubator's role in facilitating connections with healthcare professionals, regulatory authorities, and potential investors was instrumental in accelerating the commercialization process.
Results	The successful collaboration between the Innovation Incubator and Nodeus Solutions resulted in the development and commercialization of the Kokoon teleassistance solution. The innovative device, showcased at CES in Las Vegas, garnered significant attention for its groundbreaking features and potential impact on the well-being of elderly individuals. Key performance indicators (KPIs) include the number of patents filed, market traction achieved, and partnerships established with healthcare providers and technology partners.
Lessons learnt	The experience gained from incubating Nodeus Solutions and Indienov highlighted the importance of fostering interdisciplinary collaboration, facilitating access to resources, and providing tailored support to startups developing disruptive technologies. By leveraging the expertise and infrastructure available within the Innovation Hub Ageing and Well-Being, startups were able to overcome technical challenges, navigate regulatory requirements, and accelerate product

	development timelines. Continuous evaluation and feedback mechanisms were essential for refining incubation programs and addressing the evolving needs of entrepreneurs. The success story of Kokoon exemplifies Ulysseus' commitment to promoting innovation and entrepreneurship within the university ecosystem. By incubating startups like Nodeus Solutions and Indienov, the Innovation Incubator contributes to the development of a vibrant innovation ecosystem that drives economic growth and societal impact. Synergies with other Ulysseus initiatives, such as research-industry collaboration programs and open innovation platforms, further amplify the Incubator's role in fostering research-driven entrepreneurship and facilitating technology transfer for regional and global impact.

Development of Incubator Programme (IH HH)

ERAH Pillar/Objectives: The networking of experts in the field of Artificial Intelligence through the active participation of researchers, students and associated partners.	
IDs ERAH measures: • Promoting cross disciplinary research and application of AI in business and education environments • Engagement of teachers and lectures on the implications of the use of AI in education. • Integration of data driven approaches related to the use of AI as an innovative tool for SMEs.	
Key words/tags: AI, Artificial Intelligence, Stakeholder engagement, innovative AI, Applied AI	
Coverage: • Local/national, incorporate the active involvement of SMEs and associate partners in the actions of the hub to foster collaboration between students and HEI • Ulysseus/Global, the application of AI from an educational and business point of view to identify key international trends and future transdisciplinary approaches	
Description & objectives	Provide the platform to develop key Applied AI infrastructures and develop a knowledge base formed through the interaction of students, lecturers, and researchers. The enhanced integration and testing of AI solutions both from an educational and business point of view, intersecting the key strategies of the EU to enhance the role of HEIs in the European Higher Education Area. The further development of an AI research group between the partners, drive by the hub, The outcomes related to the actualisation of AI research in the context of applied AI related to business and education with the involved input from students as a catalyst. The development of a student-centred incubator programme based on the use of AI in entrepreneurship funded under the Erasmus+ programme. This has led to the active development of a new incubator programme.
The history of the use case	The AI Innovation hub has led the development of a new European approach to a student-centred incubator programme that will be co-developed through the cooperation of Ulysseus partners innovation hubs and lead to the establishment of a European wide incubator programme based on the use of AI.

Resources	Funding for the development was achieved through the planning and submission of a proposal under Erasmus+. Partners worked to develop the proposal and in doing so joined their expertise to produce a successful proposal that is based on the use of students to test and evaluate a new AI and entrepreneurship programme that will develop new approaches to the use of AI.
Planning & Realization	The preparation of the proposal involved the expertise from a number of different thematic areas and specifically AI experts and coached and mentors from the start up/incubator spheres of influence. The goal being to develop a cross-thematic approached to a EU wide need to develop a new incubator programme based on the use of AI and a tool for innovation and renewed entrepreneurial mindsets, of which are in line with the key priorities of the EU Innovation Agenda and Erasmus+ programmes. The development of the incubator programme will involve 75 students, 20 key experts in the fields of AI and entrepreneurship and 20 associate partners. The role of the associate partners will be to provide reverse-pitching challenges for students groups to solve using new innovations founded on the use of AI tools as part of entrepreneurship
Results	The incubator programme will spearhead the development of a joint incubator programme between 6 HEIs as part of the Ulysseus innovation Ecosystem, 75 students and 20 associate partners will take part in the funded project. This has also fuelled the research of AI topics in the field of entrepreneurship with current proposals having been submitted based on this foundation. The interaction of AI, Educational and entrepreneurial experts has been influential to provide a unique approach to excellent and innovation in the development of new approaches to the of incubators in the context of research and the EHEA.
Lessons learnt	The collaboration between researchers, lecturers and students provided a unique platform for the development of a unique application and subsequent project. This interaction is at the heart of the AI Innovation hub and provides an example to show the true and actual collaboration within the Ulysseus analyse. The interaction of companies within the ecosystem takes a unique approach to ensure they are able to fully participate in the planning and actual participation within the activities of the hub or project. However, it is this interaction between business and research with the additional input from students, that is truly beneficial and at the heart of what the AI hub wishes to achieve.

EIT Regional Hub as Local R&I Business Creation Support (IH TUKE)

ERAH Pillar/Objectives: Cooperation & Networking	
IDs ERAH measures: Regional Innovation Hub	
Key words/tags: matchmaking, networking, business creation support, research, innovation	
Coverage: regional (middle east Europe)	
Readiness level: TRL7 with continual enhancement	
Description & objectives	In 2018, the launch of the EIT RawMaterials Regional Center Košice was a significant milestone for the Technical University of Košice. As part of the broader EIT RawMaterials community, this hub aimed to bring together various stakeholders and key players to drive research and innovation in raw materials. One of the main goals of the Regional Center was to raise awareness about the opportunities provided by EIT RawMaterials and to foster connections among stakeholders. This involved organizing events and activities to facilitate networking and collaboration. Additionally, the Regional Center worked on connecting potential project ideas and partners to promote innovation. By bringing together people with different expertise and resources, the Center aimed to support the development of impactful projects. The activities of the Regional Center revolved around three main areas: 1. Networking, 2. Education, 3. Business Creation & Support. These initiatives aimed to engage and empower individuals and organizations within the raw materials sector. Managed internally by the Faculty of Mining, Ecology, Management, and Geotechnology at the Technical University of Košice, the Regional Center utilized existing knowledge and resources to maximize its impact. Today, the EIT RawMaterials Regional Center Košice continues to serve as a hub for innovation and collaboration, driving progress in the raw materials field for the benefit of the region.
The history of the use case	The Technical University of Košice (TUKE), through its Faculty of Mining, Ecology, Management, and Geotechnology, joined the EIT RawMaterials community in 2015. This followed numerous meetings at brokerage/matchmaking events across Europe, as well as in Brussels and at the European Commission.

	TUKE became actively engaged in international project collaboration in the field of raw materials and related topics during this phase. Initially, its involvement was limited to partner roles within project consortia, with high workloads and limited resources. However, TUKE gradually increased its participation, entering the community with three approved projects and exponentially increasing its project portfolio year by year. Over the course of five years, TUKE succeeded in attracting 25 projects from the EIT RawMaterials community. Over time, TUKE has gained the ability to develop its own project ideas, form consortia, and coordinate projects. Thanks to its strong performance, strategic geographic location, and active participation in EIT RawMaterials East partnership meetings, TUKE received support from the East Co-location Centre to establish the EIT RawMaterials Regional Center Košice. Formally established in 2018, this center represented a pioneering concept of its kind in Slovakia.
Resources	The operation of the EIT RawMaterials Regional Center Hub was supported by grant resources from the EIT RawMaterials community on an annual basis. A certain level of co-financing in the form of in-kind or FTE contributions was positively perceived. However, the operation of the center indirectly relates to TUKE's active membership in the EIT RM community, which requires the payment of an annual fee. The amount of membership fee varies depending on the level of grant support received from EIT RM projects. As a result, relevant ministries, particularly the Ministry of Economy of the Slovak Republic, were regularly informed/visited to discuss potential compensation of membership fees based on the political situation and understanding of the benefits of activities. TUKE utilizes its own personnel capacities for this work, individuals with a history and experience of involvement in EIT RawMaterials activities, although not at full FTE capacity.
Planning & Realisation	The planning of activities at the EIT RM Regional Center Košice occurred on an annual basis, with activities being formulated and proposed without a systematic approach or specific instructions from EIT RM. The activities consistently aligned with the following pillars: Networking and matchmaking: This pillar involved proposing smaller events and one major event per year aimed at bringing together active stakeholders from various sectors, including industry, policy-makers, non-profit organizations, associations, universities, and research institutions. Emphasis was placed on active industry participation with links to academia. Collaboration with the largest technological conference in Slovakia facilitated the influx of new stakeholders into EIT RM activities and increased visibility of the raw materials sector. Bilateral meetings with relevant stakeholders were also conducted, with the aim of identifying project collaborations and engaging as many stakeholders (both existing and new) as possible in EIT RM activities. Business creation and support: Activities under this pillar included searching, identifying, and scouting for suitable applications for EIT RM support schemes (such as EIT Jumpstarter, SME Booster Call, etc.). The

	center also co-organized local events and training sessions focused on promoting entrepreneurship, commercializing research, technology transfer, and guiding interested parties towards support schemes and competitions. Education: The center provided local support and co-organized educational models provided by EIT RM, such as remote sensing training for researchers and professionals, as well as for teachers and students (especially at the PhD level but also at lower levels) to enhance their capacities. The hub center's role was to reach out to target groups, ensure their participation in events, inform them, and enhance their qualifications. In terms of geographical scope, the EIT RM Regional Center Košice operated not only in Slovakia but also in the Czech Republic, Hungary, Romania, and Ukraine.
Results	The operation of the EIT RM Regional Center Hub Košice resulted in higher awareness and strengthening the regional ecosystem and the components of the knowledge triangle through the aforementioned activities, with approximately the following figures achieved: • Bilateral meetings/consultations: 120 • Participants in networking/ matchmaking events: 1 000 • Formal cooperation with organizations: 50 • Participants in BC&S activities: 150 • Participants in Education activities: 300 • Collaboration leading to project cooperation: 15 Thanks to the Hub's activities, awareness of EIT in Slovakia among national authorities and regional self-governing bodies has increased. EIT in Slovakia was relatively unknown until now. Several meetings were successfully held with the Office of the Government, which EIT took into account in its strategic documents for future periods (e.g., for the Recovery and Resilience Plan, among others). With the Hub's assistance, numerous flagship projects under the KAVA EIT RawMaterials scheme have been successfully executed and implemented, including 4 coordinating projects. These initiatives exemplify sustainable mining practices in Slovakia, such as those incorporating closed-loop water systems and other innovations.
Lessons learnt	Due to the specific characteristics of each region, it was necessary to implement pilot activities in Slovakia. The first two years of existence were largely focused on supporting the ecosystem in Slovakia. In the 2nd and 3rd years, expansion occurred into the Czech Republic. In the 3rd and 4th years, the scope expanded to Hungary, Ukraine, and Romania. This gradual process was essential for identifying patterns, understanding stakeholders, and the overall environment of each ecosystem, enabling activities to be effectively implemented. Regarding matchmaking execution, pitch sessions did not prove successful in Slovakia. They were poorly understood by stakeholders, and there was little interest in presenting project ideas. This may be related

	to a fear of idea misuse, which still prevails in the business sector in Slovakia due to a lack of trust between entities. In terms of the effectiveness of networking and matchmaking formats, based on experience, bilateral meetings were found to be more effective than mass gatherings/events in Slovakia, especially in the minerals sector. Therefore, the format of individual stakeholder visits was chosen more frequently, allowing for better identification of needs and proposed solutions.

New Forms of Education and Training

Learning Lab (IH UniCA)

ERAH Pillar/Objectives: Pillar: Education and Training Innovation Objectives: Advancing Learning and Collaboration through Experimental Education	
IDs ERAH measures: Promoting Educational Innovation Enhancing Collaboration in Learning Environments	
Key words/tags: Learning Lab, Educational Innovation, Collaboration, Experimentation, Creativity	
Coverage: Local/national	
Description & objectives	The Learning Lab serves as a dynamic space for educational experimentation and innovation within the Innovation Hub at Université Côte d'Azur. Its primary objective is to revolutionize traditional teaching methodologies by leveraging emerging technologies, fostering collaboration, and promoting creativity among students and educators. Through a combination of hands-on experiences, interactive workshops, and digital resources, the Lab aims to cultivate essential skills such as critical thinking, problem-solving, and digital literacy. By embracing the principles of MOOCs, collective intelligence, and web 2.0, the Lab seeks to empower learners to adapt and thrive in a rapidly evolving knowledge economy.
The history of the use case	The inception of The Learning Lab can be traced back to a collaborative effort between Université Côte d'Azur, industry partners, and educational institutions. Recognizing the need to reimagine traditional learning environments in response to the digital revolution, stakeholders embarked on a journey to create a cutting-edge educational facility. Drawing inspiration from global trends in educational innovation, the concept of The Learning Lab evolved over time, with each phase characterized by strategic planning, stakeholder engagement, and iterative development. The Learning Lab's history is marked by a commitment to experimentation, continuous improvement, and the pursuit of excellence in education.
Resources	The establishment of The Learning Lab required a significant investment of resources, both financial and human. Funding was secured through a combination of university grants, industry partnerships, and government initiatives aimed at promoting educational innovation. Key

	resources included state-of-the-art technology infrastructure, digital learning tools, and instructional materials. Human resources encompassed a multidisciplinary team of educators, technologists, and support staff dedicated to realizing the vision of The Learning Lab. Collaboration with industry partners provided access to expertise, best practices, and real-world insights, enriching the Lab's educational offerings and enhancing its impact
Planning & Realisation	The establishment of The Learning Lab within the Ageing and Well Being IH involved meticulous planning and execution, aligning with the overarching goal of fostering educational innovation. Collaborative efforts were undertaken with industry partners, educational institutions, and technology experts to design a cutting-edge learning environment. Emphasizing the principles of MOOCs, collective intelligence, and web 2.0, the Lab's planning phase focused on creating dynamic spaces conducive to experimentation and collaboration. During the realization phase, the vision of The Learning Lab came to life through the implementation of innovative teaching methodologies and the integration of emerging technologies. The curriculum was carefully curated to encourage creativity, critical thinking, and active participation. State-of-the-art facilities and digital resources were deployed to facilitate immersive learning experiences. The Lab's physical infrastructure was designed to promote interaction, communication, and a sense of community among learners.
Results	The Learning Lab has emerged as a beacon of educational excellence within Université Côte d'Azur, attracting students, educators, and industry partners alike. Through its dynamic approach to learning, the Lab has sparked creativity, nurtured collaboration, and cultivated a culture of innovation. Key performance indicators, including student engagement metrics, participant feedback, and industry partnerships, reflect the Lab's success in achieving its objectives.
Lessons learnt	The journey of establishing The Learning Lab has provided valuable insights into the evolving landscape of educational innovation. Flexibility, adaptability, and responsiveness to emerging trends have been essential in shaping the Lab's offerings and maximizing its impact. Continuous feedback loops and ongoing evaluation mechanisms have enabled iterative improvements and refinements to the curriculum and teaching methodologies. Additionally, fostering a spirit of inclusivity and diversity has been instrumental in creating a welcoming environment within our IH that empowers learners from diverse backgrounds. Additionally, the success of The Learning Lab aligns seamlessly with Ulysseus' strategic imperatives of promoting innovation, collaboration, and lifelong learning. By serving as a catalyst for educational experimentation and industry collaboration, the Lab contributes to the development of a skilled workforce equipped to thrive in the digital age. Synergies with other Ulysseus initiatives, such as research-commercialization programs and talent development initiatives, further amplify the Lab's role in driving excellence and impact within the university ecosystem.

Researchers Workshop (IH MCI)

ERAH Pillar/Objectives: 8. Sciences quality, international collaboration	
IDs ERAH measures: workshop for researchers	
Key words/tags research collaboration	
Coverage: Ulysseus/Global	
Description & objectives	This workshop hosted by the MCI aimed at providing researchers the opportunity to meet, explore and discuss potential collaborations in forthcoming Horizon Europe project proposals in the areas of food systems, biotechnology & circular economy.
The history of the use case	The objective was to connect Ulysseus researchers as well as other researchers to jointly work on calls for proposal (Horizon Europe calls). The goal was to build new consortia for Horizon proposals.
Resources	Internal resources + Compass project budget
Planning & Realisation	In preparation of this workshop, participating researchers were asked to fill in an online survey to select the Horizon calls they were the most interested in. Based on this survey results and the number of attendees, two calls were retained to be discussed in groups during the workshop. On the first day of the workshop, researchers presented themselves via short "pitches" on their research work and potential research interests. Researchers were then divided into groups based on the preferences for the calls they had previously identified during the survey phase. Participants sorted in groups were then asked, during a co-creation session, to read the calls thoroughly and identify keywords, actors &stakeholders, and cross cutting issues. Afterwards, each researcher was required to pitch an idea. These ideas were then displayed onto a board and submitted to a vote. The two ideas receiving the most votes were then presented to the group. On the second day of the workshop, the co-creation session continued and allowed researchers to further develop, discuss and refine their ideas. Handouts modelled on HE calls structures were then given to the two groups. These handouts allowed researchers to summarise their proposals and provided a written trace of what had been discussed and worked on during the workshop. At the end of the second day, a feedback session was held. This feedback session allowed the organisers to be informed on how to improve the organisation of future workshops and to determine what would be the next steps for the participating researchers.
Results	This workshop allowed researchers to connect and network. But more importantly, the purpose of the workshop was to build consortia for EU-HORIZON calls. During this workshop, two projects could be developed and concrete ideas were analysed, discussed and implemented hands-on.

	A very concrete outcome of this workshop was a joint Horizon Europe proposal. Three Ulysseus partner Universities were involved along with other external partners met during the workshop.
Lessons learnt	This type of workshop requires a lot of preparation in advance to identify the needs and interests of researchers. Identifying the potential calls and obtaining feedback from the researchers is crucial to ensure the success of this type of workshop. Out of the two calls which were discussed and worked on during the workshop, only one call led a concrete proposal submitted by the involved partners. Hence, in hindsight, a pre-meeting for the researchers would have sped up the co-creation process during the physical workshop and maybe allowed for both calls to be turned into concrete proposals.

MOOC (IH MCI)

ERAH Pillar/Objectives: Open science	
IDs ERAH measures: Open classes	
Key words/tags: open science – education	
Coverage: *Ulysseus/Global*	
Description & objectives	The Ulysseus MOOC on Sustainable Development provided all learners, who wished to get general overview of the topic, inspiring examples and practical implications of sustainable development.
The history of the use case	Sustainable development is at the centre of attention of the EU as well as many international organisations. Against this background, the creation of a MOOC on Sustainable development was of crucial importance for the Ulysseus Alliance.
Resources	Internal to each partners institution within the Ulysseus Alliance
Planning & Realisation	Ulysseus partners involved in the preparation process brought their respective courses related to sustainable development. That way, each module offered different perspective to the participating learners. A total of 6 modules were proposed: Climate Change, Environmental Justice and Ethics, Circular Economy in Business, Circular Economy and Biotechnology, Sustainable Cities, Sustainable Tourism, Sustainable Transition in Rural and Urban Context. MCI was in charge of the module on Circular Economy and Biotechnology. This MOOC was offered in English and awarded participants 3 ECTS. The MOOC was suitable for Bachelors, Masters & PhDs. The MOOC targeting the following group: Students, Non-academic staff, Academic staff, Citizens and Mature students. This MOOC was hosted on the Moodle platform.
Results	Learners acquired knowledge and understanding of the topic. Afterwards, they were able to apply, analyse, and evaluate issues related to Climate Change, Environmental Justice and Ethics; Circular Economy in Business; Circular Economy and Biotechnology; Sustainable Cities;

	Sustainable Tourism; Sustainable Transition in Rural and Urban Context
Lessons learnt	*NA*

BIP on Project Management (IH MCI)

ERAH Pillar/Objectives: 6. RDI discrepancies reduction within ERA ecosystem and between ERAHs	
IDs ERAH measures: Workshops and training for researchers	
Key words/tags: training	
Coverage: Ulysseus/Global	
Description & objectives	The MCI hosted a BIP (Blended Intensive programme) on EU project management. The objective of this BIP was to provide researchers and project managers with the knowledge and tools for successful application for EU calls for funding.
The history of the use case	Within the Ulysseus Alliance and for each respective partner institution, applying for European funding is crucial for promoting and enhancing research & Innovation. Hence, providing those who apply for such funding with the necessary skills and tools was very important for all actors of research and innovation within Ulysseus.
Resources	Internal resources + BIP budget
Planning & Realisation	This BIP was run from Monday to Friday. As all BIPs, this week of presence was preceded and followed by online components. The following topics were covered within workshops settings: • National Contact Points • Diversity & Communication in Intercultural Projects • Gender Dimension in EU Projects • Erasmus + • Horizon Europe • Intellectual Property Right in EU Projects
Results	This BIP allowed participants to engage hand-on with practical examples and exercises to develop skills necessary for applying for EU calls for funding. Participants with more experience were able to share their knowledge with new comers to EU funding application, creating synergies between researchers and project managers.
Lessons learnt	*NA*

Data Driven Living Lab and Its Integration Into Education

Transactional Data Living Lab for AI Driven Supply Chain Management and Its Integration to Education (IH TUKE)

ERAH Pillar/Objectives: Science and HEI quality	
IDs ERAH measures: (edu)Living lab	
Key words/tags: data sharing infrastructure, data from real procurement processes, research, education	
Coverage: In the beginning: local. Now on EU level.	
Readiness level: TRL7 with continual enhancement	
Description & objectives	The transaction data living lab for AI driven supply chain management was established by Radoslav Delina – researcher on TUKE (Technical University of Kosice) on the base of cooperation with the e-procurement platform formerly called Proebiz (now TenderBox) with the aim to study procurement and negotiation processes and related behaviour or suppliers and procurers in B2B. As the main focus was on data science, the living lab is the virtual data space. Data now consists from private/sensitive sources and from open data repositories esp. from procurement processes, financial statements from open national registry, registry of business partners and open contracts covering millions of records. The main objectives are: • Increased data science quality based on real data validating experimental economy studies and enhancing methodological approaches on observational data. • To create stakeholder community around living lab with potential to implement R&I results on open or commercial base. • Increase quality of education in the context of data economy and data driven decision making based on real problems and real solutions. • To establish start-up companies based on this data ecosystem, data and real problem understanding in cooperation of researchers and students. • To internationalise transactional data research in B2B and public procurement, to enhance data warehouse within international data ecosystem and utilise international research and educational capacities. • To implement international educational processes based on international transactional data living lab for AI driven supply chain management to increase student's capabilities of problem solving in international teams, for international stakeholders and with help of researchers from international R&I academic environment. Currently, within living lab international research activities are realised with strong international stakeholder community co-operating and co-creating R&I results for solving their challenges and needs, one start-up is established, PhD studies are incorporated with integration of local educational processes. The expectations for 2024 is to enhance educational living lab processes into the Ulysseus international academic

	environment as internationalisation initiative of education and as a part of COIL actions.
The history of the use case	In the beginning the main dataset was obtain from Proebiz company, the most significant procurement SW provider in Czech and Slovak Republic with the most complex negotiation algorithms for B2B. The first objective was given on realising research on this data to improve data science results on observational data from auction environments. Continually, datasets were enriching by other sources mainly from open public procurement data repositories, contract repositories as well as financial and business registries to compare behavioural patterns, identify and understand higher complexity of decision making and potential negotiation or risk management strategies. As different data sets were processed, on the beginning, simple data sets were accessible on the cloud. After the data size was significantly increased, the database was established with an access to agreed members of living lab. As living lab contained also private and sensitive data from commercial procurement processes, NDA with Proebiz as well as with living lab members was needed to be established and agreed. Rules for data manipulation was proposed. After 2015, the data was implemented into the education, esp. in two subjects: Financial Decision Making and Electronic Business. This enhancement transformed living lab into the model of edu-living lab integrating data, problem solving into the educational process with the aim to increase interest by students into data science and related PhD study. The uniqueness is based on problem formulation by world of practice within this stakeholder community platform, where real problems are set up to be selected by students creating relevant students groups. The results are now assessed by researchers, living lab members with partial assessment of end users. The vision is to integrate wider stakeholder community into the problem formulation (problem solving marketplace) and final assessment of solutions proposed and tested by student groups. After 2018, living lab results achieved recognition within large companies and public procurers. The visions, ideas and solutions for digital transformation of procurement was the base of workshops and discussions with industrial and public players. Nowadays, the living lab is the space for international students, researchers and innovators to work with data, to think and brainstorm around possible innovation for new age of procurement management with the potential of creating sound startups and high quality research. During past years, start-up ideas creation faced success but also fails, where two startup ideas were not managed properly by IPR, no code of conduct existed and the final solution was taken by third parties outside of living lab member community. This led to the understanding of the legal support and IPR mentoring importance, which was found in Technicom Startup Center of TUKE, where one start-up was placed in 2024.
Resources	Main resources in the beginning of the living lab life were research grants and related national and EU funding. After being recognized by B2B players and students, the sense of own resources of the head of living lab and students' efforts were utilised to continually enhance

	datasets, to improve data quality and to establish suitable data infrastructure. As one start-up was created from this living lab actions, this is used also for private funding and resources sharing to ensure sustainability and win-win (educational/research – commercial) strategy.
Planning & Realisation	Main activities in the beginning was focused on sharing datasets obtained from commercial players and in cooperation with students to aggregate open data into one data space. Whole data living lab was virtual, in the beginning only on local harddrives or google or other drives/clouds, later transferred into the HPC cloud for better data sharing and High computational performance requests. needed to be undertaken. This HPC server was provided by TUKE and is used in R&I sharing infrastructure model (sharing with other research groups and TUKE activities). During developing living lab, several problem arose: • How to set up NDA with students participating or working on sensitive data. • Scalability and HPC requests for high quality and complex research tasks • How to share ideas and co-work with potential innovators with confident and absence of unfair practices in local but also international environment. Answers on these problems were searched continually by learning by mistakes. Final solution is based on NDA signatures with selected researchers/research supervisors ensuring code of conduct or subNDAs signature with research team or related living lab members. HPC requests were solved by TUKE local HPC infrastructure service and R&I sharing model. The research problems, visions and potential innovative solution based on data models were presented on professional platform of procurement managers organized by Proebiz company, which served as the pool of knowledge, requests, innovative consultancy and potential request of interest for real innovative solution adoption into their real environment. This platform called Procurement Board is led by Proebiz company and is involving around 30 significant procurement managers and directors of procurement units in large companies with international focus. This platform is our core stakeholder community motivating members of living lab to conduct researches and results with real opportunity to be adopted in these companies. Around this community of stakeholders and Proebiz company, the largest professional procurement conference called procurement festival is organized each year. This eBF conference is the place to share our ideas and results with end user community beyond Procurement Board around 600+ procurement managers and to promote real innovation as commercial service with market potential. International living lab is now based on similar approaches with enhancing R&I sharing infrastructure based on semi-open access to data warehouse, which is continually enriching and increased in data quality by opening living lab to international research groups (in the first stage within Ulysseus ecosystem as ERAH model).

	Realization of edu-living lab enhancement and the integration LL into the education was realised step by step and continually tuning the strategy how to incorporate students into the problem-solving projects. In Financial Decision Making, students are divided into the groups which are selecting innovation problems. Then on the base of mentoring or consultancy of lecturers, researchers, diploma thesis supervisors, many times the same people are people from practice, students groups are proposing solutions, testing data models and presenting final solutions which are assessed by members of living lab with the planned enhancement of model where assessment will be done by end users community. This plan allows also to profile students based on their achievements generating perspective profiles for their CVs or responses on HR requests by end-users community of the living lab. From 2022, students are integrating also into the commercial procurement courses leaded by procurement leaders in Central Europe as a integral part of Financial Decision Making subject providing possibility to achieve also private certificate of Digital procurement manager. In the Electronic Business subject, students are training their skills in formulating procurement strategies and data driven decision making inside the commercial procurement SWs shared with the edu-living lab by Proebiz company as strategic partner of stakeholder community. Future plans for 2024 are focused on Datathons/hackathons integration into the education with Prize awards published by stakeholder community to solve their problem and to increase internationalisation of students group and related educational activities within Ulysseus COIL model.
Results	Our initiative to develop Transactional Data Living lab for AI Driven Supply Chain Management brought significant success and impact on research, innovation and education: • Increased R&I data driven research quality, publications and cooperation with practice. • Strong community of stakeholders and potential purchasers of living lab's innovation results. • Startup ideas creation with one stable start-up company established now placed in University Startup Center. Startup company is being open to students, esp. PhD students with an interest to cooperate on real data driven innovation. • Increased quality of data driven education and transfer of R&I results into the education. • Increased data science and data driven problem solving skills of students. • Generating qualified students with historical experiences/reputation from students' projects as potential employees for stakeholder community involved in living lab. • Increased motivation and interest expressed by students to continue on PhD studies. Living lab with its edu-living lab feature is easily transferable into external academic or R&I environment by R&I sharing infrastructure model, allowing benefit from international research and educational environment. This living lab is an nice example of ERA Hub model integrating

	education, research and innovation into one single ERA and HEI area with growing potential for breakthrough innovation for the practice.
Lessons learnt	The main crucial success factors were: • The cooperation with practice, esp. main SW providers providing data from real processes. • NDA model between Living lab and SW providers or end users and between Living lab research supervisor and his research team. • Code of conduct how to use data and how to utilise innovation potential. • Integration data and real problems identified within cooperation with stakeholder community into the education, where students groups are providing solutions based on real data, real problems and real expectations from the world of practice. • Internationalisation of living lab research members and educational environment.

Stakeholders community building

Stakeholders community building at IH USE

Key words/tags: *Industrial Chairs, university-industry cooperation, regional innovation, technology transfer at IH USE*	
Coverage Local	
Description & objectives	In recent years, the University of Seville has made a great effort to consolidate and diversify a **network of Industrial Chairs** that reflect the university diversity and its potential for transferring knowledge to society. Currently, there are 43 Industrial Chairs (see the full list here) and they cover all areas of knowledge between the academic world and the business environment. The Chairs are located in various departments of the university and are led by a senior university professor, as Chair Director, in collaboration with representatives of the partner company. The Chair activities are very broad, ranging from various forms of education (teaching courses, workshops, seminars, customised training for technical staff, etc.), interdisciplinary research, development of strategies, technologies, management methods and approaches, development of a business and entrepreneurship culture in young university students, development of collaborative work, leadership, innovation and creativity, organisation of various events, awards, etc. The Industrial Chairs fulfil several functions, as follows: • Promotion of cooperation between companies and the forefront of research and knowledge generated at the University. • Contribution to the training of future professionals in the areas of work and research of interest to the Chair.

	• Revitalization and stimulation of the relationship between the university and society through the productive sector, guaranteeing the transfer of knowledge through innovation and research. The university provides significant support, together with the Social Council, to promote this way of collaboration. To this end, it has been responsible for promoting collaboration and sponsorship agreements with companies and other institutions aimed at the constitution and financing of chairs related to all areas of knowledge.
Resources	The partner company of the Industrial Chair acts as a sponsor for the Chair's activities.

Local stakeholder engagement at HH

ERAH Pillar/Objectives: The networking of experts in the field of Artificial Intelligence through the active participation of researchers, students and associated partners.	
IDs ERAH measures: • Promoting involvement of local stakeholders • Engagement of researchers and lecturers • Providing platform for research and collaboration	
Key words/tags: AI, Artificial Intelligence, Stakeholder engagement, innovative AI, Applied AI	
Coverage: • Local/national, incorporate the active involvement of SMEs and associate partners in the actions of the hub to foster collaboration between researchers and local stakeholders • This action is in progress and elaborated more widely as part of Ulysseus project stage 2 financed under Erasmus+ Programme.	
Description & objectives	Provide a platform for local stakeholders and researchers to meet and interact as part of the activities of the innovation hub. This was also conducted in cooperation with the European Digital Innovation Hub, FAIR, Finnish AI region. Local researchers and businesses associated with FAIR and Haaga-Helia with the innovation taking a key role in facilitating the interactions.
The history of the use case	The AI Innovation hub provided the opportunity to combine expertise on the topic of AI with the active input of regional stakeholder. The FAIR EDI accelerated this as the partners of the EDIH took an active role in the hubs activities.
Resources	The innovation hub provided the space and networking opportunities for the interaction of 10+ local stakeholders. The actual Innovation Hub was provided for stakeholders and companies to meet as part of AI clinics to discuss the role of AI in their operations.
Planning & Realisation	The preparation of the meetings was undertaken in cooperation with the stakeholders of the EDIH and project researchers in HH with the innovation hub coordinating the actions.

Lessons learnt	The collaboration between local stakeholders, business and HEI is important and relevant and also provides students future opportunities for collaboration whether through work placements or thesis topics. Working with stakeholders takes time and needs to have a true added value for their time spent.

Satellite Projects Development (IH HH)

ERAH Pillar/Objectives: Increased scientific collaboration and participation in R&I projects	
IDs ERAH measures: • Promoting cross disciplinary research and application of Erasmus+ and Horizon Europe proposals • Engagement of researchers and lecturers • Align proposal themes with innovation hub research areas	
Key words/tags: AI, Artificial Intelligence, Stakeholder engagement, innovative AI, Applied AI	
Coverage: • Local/national, international • vs Ulysseus/Global, the application of AI from an educational and business point of view to identify key international trends and future transdisciplinary approaches.	
Description & objectives	Under Ulysseus a Satellite Project consists of 2 or more Ulysseus partner institutions who collaborate together to develop a project that has a connect to at least one of the innovation hub thematic themes. The goal being to advance the collaboration of lecturers, researchers and students of each Ulysseus partner. The topic of the proposal would also compliment the current activities of the innovation hubs through additional funding.
The history of the use case	The AI Innovation hub has led the development a number of proposals under Erasmus+ and Horizon Europe. The AI Innovation Hub has led the preparation of 11 Erasmus+ and taken part in a further 11. In addition HH has taken part in the preparation of 10 Horizon Europe proposals. This has been made possible due to the support provided by Haaga-Helias dedicated Research Services department and the guidance provided by the AI Innovation. Within Haaga-Helia there is a streamlined process to encourage, engage and provide practical support in the actual preparation of proposals, both under Horizon Europe and predominately under Erasmus+. Erasmus+ has been particularly useful in the case of Haaga-Helias approach to the applied uses of AI in business and educational context. In addition, Haaga-Helia also responses strengths related to Vocational education and Teaching for which Erasmus+ has been targeted.

	The main strands under Erasmus+, Cooperation Partnerships, Alliances for Innovation and Capacity Building in Higher Education, all have aspects that related directly to the activities of the Innovation hub and also address key strategic synergies in Haaga-Helia.
Resources	The AI Innovation supported the active production of the proposals and in addition, coordinated the formation of writing teams between lectures, researchers and associate partners. The process is further supported by Haaga-Helias research services who has specific expertise in building competitive proposals and by doing so provide additional practical knowledge in developing proposals in tandem with the thematic experts. The research services provide specific guidance on EU policy, budgeting, course development, impact, and work package design, providing substance experts the resources to focus on addressing the key scope of the calls.
Planning & Realisation	The preparation of the proposals took the form of a number of online sessions and workshops to elaborate the proposals objectives, tasks, deliverables and budget. Haaga-Helia has made the decision to take an active role in leading the preparation of proposals that directly address the key thematic area of the Innovation, being the applied use of AI in Business and Educational contexts. The innovation hub led the development of proposals using a three-tiered approach involving our international research services, AI innovation members and external experts made up of Ulysseus partners. The process was then led by the Innovation hub managers to direct the goals and practical timeline the proposal generation. In addition to the preparation of the proposals there is a strong synergy between the Innovation Hub and Research Services to develop consortium agreements and also provide support for specific EU funding platforms needed for reporting and general funding support.
Results	There are currently 13 active Satellite Projects of which HH and the Innovation are leading 5 on behalf of Ulysseus.
Lessons learnt	The key to ensuring the preparation of a strong proposal is to provide the platform for lecturers and researchers to collaborate and build the proposal. In addition, the role of the AI innovation hub was to provide support to those preparers and align the proposals with the goals of the Ulysseus Innovation ecosystem.

Annex 5: Lessons Learned, Success Factors, and Challenges from Other ERA Measures and ERA Hub Actions

Based on presented approaches and continuously applied models and planned expansions within good practices, we summarize experiences in associated areas of ERA measures and practices, which are a priority area of other deliverables or projects. Here, however, we summarize lessons learned mainly from the perspective of synergistic effects arising from the implementation of connected ERA measures into living lab environments, their integration into education, and the innovative environment in the international setting of the Ulysseus ecosystem. These reflect the experiences of involved researchers, students, and stakeholders.

Ulysseus Support services to researchers (trainings, visits, mobilities)

Improving the skills and competencies of researchers is one of the advantages of internationalization of the connected system of research, innovation, and education. Through educational activities and research mobilities, this model increases the attractiveness and motivation of researchers to stay in research, improve their skills in multidisciplinary areas, especially currently improving the linking of the research domain area with new advances in data science, AI, inclusion, responsible economics, and ethics. Trainings and education for researchers through shared training frameworks such as open classes, webinars on specific research and innovation problems, COILs, or BIPs approaches have great potential to inspire and help transfer this knowledge to the local environment, generating new application opportunities, technologies, and transferability of knowledge to other domains. Another major positive is the integration of students into an international educational environment supported by student mobilities. An important focus of these activities towards R&I intensive areas of education for better transferability of knowledge about the significance and possibilities as well as risks of R&I trends in the field of education. This increases the attractiveness of the R&I area for students and the motivation to stay in research, ideally at the PhD level.

However, the main lessons learned show that despite the existence of highly inspiring themes and lecturers from the international environment of the alliance, critical dissemination and direct targeting of the course or educational activity to the extensive and inconsistent environments of large universities involved in the international ecosystem remains. The standard approach is communication and dissemination through representatives of local innovation hubs, which introduce various effective forms of internal dissemination within their university environments. Due to the complexity of communicating a huge amount of information, the most suitable form

appears to be targeting these educational and mobility opportunities for researchers by using living lab infrastructure with clear domain focus and clear motivation to advance in skills and knowledge. These limits spamming a wide community of researchers, which often leads to future ignorance of interesting information and events.

The standard remains communication of the local Innovation Hub internally through faculty units such as Dept. of Vice-Dean for Research and Innovation, which further disseminate through established channels within the faculty environment. These channels are effective only according to the quality of internally established methods but often show shortcomings mainly based on insufficiently targeted dissemination. This problem is partially solved through aggregating interesting information at a single information site (e.g., information web pages) with options for setting alerts for certain types of information and types of end users.

	Benefits	Challenges	Recommendations
Mobilities and training/education for researchers in the international ecosystem of Ulysseus	• Applying diverse methods and approaches for a wide range of needs like researchers' visits, ad hoc trainings and workshops, BIP, COILs, open classes • Allows for the expansion of domain knowledge about current trends in multidisciplinary knowledge such as AI, data science, inclusion, circular economy, etc. • Increases motivation for researchers to stay in research as well as to increase inspiration for researchers to solve multidisciplinary problems • Supports the transfer of knowledge from participants in education to the local environment, into the environment of research groups, while generating new opportunities for applications, technologies, and the transferability of knowledge to other domains	• The critical issue remains the quality of dissemination of educational activities in the extensive and inconsistent environment of large universities involved in the international ecosystem. The standard approach continues to be communication and dissemination through representatives of local innovation hubs, which implement various effective forms of internal dissemination within their universities.	• Direct targeting of selected groups of researchers, for example, through established international research groups, living labs, or personalizing alerts for selected types of activities for researchers to reduce spam and the ignoring of future messages. • Supplementing email and internal communication channels with a unified web information channel that includes functionalities for an event calendar, setting alerts, sharing events on social networks, and related tools that have been created.
Mobilities and training/education for students in the international ecosystem of Ulysseus	• The integration of students into an international educational environment supported by student mobilities is highly valued and sought after by students. • It enables the focus of educational activities toward R&I-intensive areas for better transferability of knowledge about the significance, opportunities, and risks of R&I trends into practice. • It allows for the integration of education into existing international living lab environments, ensuring the reintegration of R&I knowledge into education and the resolution of practice-oriented problems.	• for BIPs and COILs: The funding is ridiculously inadequate for many cases. Sometimes it can barely cover the travel and a few days of accommodation, so it can be a turn of in some cases. Another issue is the administration of the BIP, its very slow, that needs to be solved so the students can benefit from the early planning cost savings. The ECTS recognition process should be more universal, faster, transparent. There is	• Enable IH responsible persons to work with AI tools for R&I networking, so they can more quickly understand the appropriateness of connecting researchers based on contextual search and then directly contact the researcher, which is generally more trustworthy communication than if an unknown vision holder from another country were to approach the researcher. • For BIPs: : the call for BIPs should be

	Benefits	Challenges	Recommendations
	• Increases students' reputation by involving them in an international research environment and integrated educational activities with a research setting based on solving practical problems. • This enhances the attractiveness of the R&I field for students and motivates them to stay in research, ideally at the PhD level. • Internationalization and short-term student mobilities increase the attractiveness of local study programs, especially in widening regions experiencing a decline in interest and a drain of students abroad.	different knowledge background at different institutions and the same title of the course can provide very different content. • MOOC: we experienced high dropout rate, therefore an organizing institution should regularly enrolled in it´s e-system just those who have completed whole course successfully, otherwise it leads to useless administrative workload.	launched at least 5-6 months prior to its realization, consequently students (teachers) will be able to plan it better throughout their academic year, they can buy air tickets cheaper, can arrange better BIP´s recognition with their academic coordinator, there will be a lower risk of a cancellation of a BIP (as it has already happened recently) • For COILs: to evaluate students by their own university. Timing of students activity is everything and requires prior information to the students

Table 2 Summary of lessons learned in supporting skills and knowledge of researchers and students

Digitalization of open science, open repositories within shared R&I infrastructure

Although the Ulysseus Open Science and open repository approach is presented in other deliverables of the Compass and Ulysseus projects, here we will summarize lessons learned from the activities of living labs and research groups around presented use cases.

Generally, there has been a growing movement towards open science and open innovation models, representing a paradigm shift in how scientific research is conducted, with the European Commission playing a crucial role. Benefits and motivation for open science are widely promoted, for example, democratization of knowledge, knowledge transparency, free access to and use of scientific information, breaking down barriers of privilege, and promoting equal opportunity for learning and innovation, fostering interdisciplinary collaboration, increasing reproducibility and transparency in research, avoiding duplication of efforts, and promoting more efficient use of resources.

However, along with its strong aspects and benefits, open science and open innovation models also face critical arguments, sustainability challenges, and risks:

- **The losses of R&I result creators**. One critical argument against open science is the potential loss of intellectual property rights and incentives for innovation. Although the reluctance to invest in research and development is generally a concern for businesses and private entities if they cannot protect their discoveries and profit from them, the pressure to translate R&I results into the economy and commercialize and deploy results as one of the crucial ERA

policy priorities can also be viewed as contradictory by researchers.

- **Concerns about the quality and credibility of research conducted under open science models**. Criticism is based on the argument that open science may lead to an influx of low-quality or unverified research being published, which could diminish the overall trust and reliability of scientific research.

- **Sustainability challenges** are also a significant factor in implementing open science and open innovation models, e.g., the financial sustainability of open access publishing, maintenance, and provision of open science or innovation, and the need for infrastructure and resources to support open science initiatives.

- **Open science and open innovation are not suitable for all domains**, where public sectors, citizen activities, and social innovation may be more appropriate than innovation with high potential to be deployed by industrial actors and to increase revenues.

Despite these challenges, there are crucial factors to increase the impact of open science and open innovation based on understanding the risks. Open science and innovation is not a generalizable approach given the different natures of science and the market. Openly sharing ideas that have high potential impact on society and the market is interesting for public and social services. Once an idea or solution is commercialisable and then successfully launched on the market with high revenues by a third party, such a scenario often demotivates scientists and innovators from sharing their solutions openly. Open innovations and science are often unsustainable if not sufficiently funded, which is one of the main critical factors discussed with scientists. This problem is also related to the imbalance in funding science and research across different EU regions, where underfunded researchers, for example, from widening countries come up with innovative solutions with global reach and do not have sufficient opportunities to protect their rights or rapidly develop innovations to a high TRL.

When accepting open approaches, it then easily happens that the solution is taken over by financially stable groups, either from the research or commercial sector, which after successful implementation demotivates less well-paid researchers from sharing these ideas, data, findings, or specific solutions. It's not just about innovations but also about excellent and groundbreaking ideas for European research projects. Researchers are then either not motivated to share and develop big ideas or remain in the role of the poor relative, who for low fees at least stays in the project consortium, which will take over various commercialization models. This therefore remains a problem and a sensitive issue given the complexity of ERA and the economic status of widening countries and their researchers. This topic is closely intertwined with brain drain or low motivation to stay in research.

Lessons learned and recommendations based on experience with the internationalization of research teams and joint research projects:

- From this perspective, one of the solutions might be better funding of science and research with public expenditures specifically targeted at challenges for the development of open science and innovations in specific areas, domains, and sectors. This would reveal weaknesses and opportunities for open science in various fields.

- Open data tend to be open, but a commercial approach is seen in data processing, uniform approaches, etc., which still leaves room for reducing the benefits of open science and open data due to low standardization of the open science environment, low data quality, high costs of acquiring services for access to open data repositories (e.g., CORE), especially for widening countries, etc. (Supporting the financing of these approaches or more efficiently seems to be the entry of the state sector into providing more comprehensive services over the open science environment. Given the larger problems of widening countries, a possible solution could be to focus on higher support for WIDERA calls for these specific needs of creation, access, and sharing for widening countries, where specific financing of services over open data, creating open repositories could reduce their low participation and opportunities in global challenges like Horizon Europe. Widening participation is also a critical part of the ERA Hub and as such should address challenges through various areas including the specific problem of access to open science, data, and relevant services.

- Another partial solution is the introduction of codes of conduct or principles of signing NDAs within potential consortia when creating and submitting project proposals, which is already a common part of some strong coordinators. In this area, however, it remains an advantage more for strong research players and coordinators of large research projects with long-standing practice given the monopsony power in this academic market.

- One of the solutions, especially in internationally created research groups around living labs, models of which were presented above, is the design, sharing, and application of NDAs or Code of Conduct systems for various purposes and areas of research teams. General acceptance of the Code of Conduct can induce an atmosphere of trust and clear rules of behaviour, which can lead to higher transparency, willingness to share ideas as well as higher efficiency and impact of such a research group. The basis is the sharing of ideas, which is often underappreciated and difficult to protect. Therefore, precisely the Code of Conduct in combination with approaches of freelancers and open digital development platforms as moderating the idea, transforming it into a project, and validating these processes and their efficiency can be an effective model

in research groups and open science.

- An important supporting tool for the Code of Conduct, however, is the enforceability of the law or alternative approaches to Online Dispute Resolutions, which can increase the credibility of digital collaboration platforms not only in trade but also in research and innovations.

In the open access and data context, one of the pillars of R&I infrastructure, which is currently becoming a cornerstone of aggregation, processing, and accessing open data or related open service infrastructure in the current boom of data and artificial intelligence. In this area, Ulysseus is approaching the development of open repository infrastructure to develop repositories for storing data and information with an open character. This context also includes HW infrastructure, on which AI tools and services provided over this data can be placed. In the development of this concept, access and solutions in the relevant deliverable of this project can be identified. Here we mention only some lessons learned related to the presented synergistic concept of ERA Hub.

In the context of data sharing, as presented in the example of TDLL and based on the push for internationalization of researchers through support for the creation of international research teams, a horizontal service infrastructure for networking researchers, possibly from the perspective of the external R&I sourcing environment, was proposed. The pilot service was tested based on open data, with deployment into the Ulysseus open digital platform environment expanding its added value by expanding the data model with data collected from Ulysseus organizations in various forms.

In the context of developing an open data infrastructure, we have identified several critical success factors based on the operations of TDLL, IH, and the Startup Center at TUKE:

Ensuring data quality and transparency: Open science relies on the availability of high-quality and transparent data. Researchers, research groups, and related living labs should prioritize data management, including data validation and documentation, to ensure the reliability and trustworthiness of the shared data and interoperability for the development of further and additional data services on an open base. The quality of data structures is key to efficient data management and utilization of its potential. This fuzzy argument is more familiar to real data scientists working with raw data from real environments following CRISP-DM methodologies. Often, the understanding of data and problems is the area where significant mistakes are made leading to low efficiency of related data services. It's not just about aggregating external data into a unified repository, e.g., data from databases like Scopus or WoS, which contain many errors and weak classification and uniqueness of identification data of researchers and their affiliations, where even paid databases of open data do not have this data in sufficient quality, but understanding the desired data structure

and quality of data even in the quantity of data collection activities within Ulysseus or other international R&I ecosystems. Understanding the combination of data quality and structure with the latest progress in AI and data technologies is critical for the sustainability of such infrastructure and its use for higher impact and quality of international networking of researchers, visibility of R&I results, monitoring trends, identifying gaps, etc. This is mainly related to the development and subsequent integration of internal legacy systems for data collection and publication by individual alliance partners or international environments, which should adhere to agreed standards and also with the collection and formulation of survey data and other data collections from communities of researchers and management levels.

Utilize internal living lab capacities, students, PhD candidates, and researchers for data collection and processing to ensure higher independence from paid services for access to open data, which hinder development in this area.

Develop cooperation with government institutions and support funding programmes for creating quality open infrastructures for open data in agreed standards. Within the support of R&I program reforms, mainly use institutional platforms as opposed to models that include individual experts in advisory and working groups due to the poor sustainability of human resources, generated knowledge, and visionary approaches.

Sharing R&I infrastructure should be managed in a two-dimensional way:

- Development or enhancement of existing R&I infrastructure of living labs through distributed sharing between members of alliances, especially for ad hoc, short-term needs enhancing and improving ad-hoc research of local or international living labs or IHs.
- Development and continual enhancement of a digital single R&I infrastructure for semi-open data and semi-open services within the whole international ecosystem of the Alliance. This should be focused on generally wide use of horizontal data and services, e.g., for R&I networking or visibility and related services for researchers, LLs, IHs, and governance bodies.

More information about open science and related repositories are available from Compass deliverable accessible from ulysseus web site.