JRC TECHNICAL REPORT

HIGHER EDUCATION FOR SMART SPECIALISATION

A HANDBOOK

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FOREWORD

The Higher Education in Smart Specialisation (HESS) project has been developed in collaboration with DG Education, Youth, Sport and Culture (EAC) since 2016 and seeks to engage stakeholders from higher education in regional development processes and regional innovation ecosystems to ensure places contribute to local and broader European growth and transformation. This handbook is the result of more than four years of analysis and cooperation with regions on how higher education institutions (heIs) can contribute to the design and implementation of smart specialisation strategies (S3).

The first edition of this handbook was published in October 2018.[1] This learning journey has since continued and is now entering a new phase, with a new EU multiannual financial framework for the period 2021–2027, new policy priorities and new funding instruments. In particular, smart specialisation is evolving, with a new enabling condition for the good governance of smart specialisation with seven fulfilment criteria aimed at enhancing the refinement and implementation of S3. Higher education and human capital more generally can play an important role in meeting these criteria.

Against this background, it is clearly time for a second edition of the handbook. This new edition retains the core aim of supporting both regions and HEIs in the implementation of smart specialisation and the effective dissemination and application of knowledge through cooperation as well as the supply of high-quality human capital. It also builds on the valuable guidance presented in the first edition, supplemented by new evidence and analysis to support understanding of and alignment with the new criteria.

As with the first edition, this handbook has been informed largely by the HESS case studies but this updated version is based upon further knowledge co-created with regions and HEIs and takes on board feedback from both national and regional authorities as well as HEIs.

Whether you are a region or an HEI, we encourage you to engage with the HESS project and join our Community of Practice.

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1   Edwards, J and Marinelli, E (eds) (2018) Higher Education for Smart Specialisation: A Handbook (Version 1.0) Seville: European Commission

EXECUTIVE SUMMARY

POLICY CONTEXT

Smart specialisation was introduced under Cohesion Policy in the 2014-2020 programming period and sought to ensure the prioritisation of funding in areas where territories could have a competitive advantage. The policy is founded upon an Entrepreneurial Discovery Process (EDP) that mobilises the key research and innovation stakeholders in the region (including higher education) to jointly analyse and exploit regional strengths and potentials.

The EU Renewed Agenda for Higher Education recognised that higher education institutions (HEIs) should engage in the development of their regions and cities, integrating local, regional and societal issues into their curricula, cooperating with businesses, involving the local community in teaching, research and lifelong learning but also building links with the local community and contributing to regional development. Smart specialisation links HEIs to their territories: the places where universities are based matter. Higher Education - at the interface of research, education and innovation - is a key asset in boosting regional growth and green and digital transitions.

In the 2021-2027 programming period there is an enhanced focus upon the development of human capital as part of the smart specialisation process under the ERDF specific objective "Skills for smart specialisation, industrial transition and entrepreneurship". This handbook responds to the incorporation of the seven fulfilment criteria for good governance in smart specialisation in the new regulatory framework but from the perspective of higher education.

KEY CONCLUSIONS

There are a number of drivers and trends shaping the behaviour of HEIs and their engagement with smart specialisation. Recent decades have seen tremendous transformation in HE with expanding HEI participation, student mobility and internationalisation. Industry 4.0 and 5.0 are set to have far-reaching implications for the nature of work and employment, and therefore for higher education, as will the COVID-19 pandemic.

Smart specialisation offers a means to integrate higher education into regional development policies and facilitate the engagement of entrepreneurial and knowledge-creating actors. The EDP relies upon stakeholder engagement and the sharing of knowledge distributed across sectors, actors and users for the identification and monitoring of priority areas throughout the design and implementation of the strategy. HEIs should be involved from the early definition of the S3 governance structures and priority areas and contribute across the three HEI missions (research, teaching and outreach/community) and S3 governance levels (strategic, technical and bottom up).

However, the S3 governance system is highly context specific and will reflect regional settings and characteristics. Differences among HEIs and higher education systems, each with their own regulatory arrangements, strategic priorities, capacities and profiles imply varying contributions to and roles within the design and implementation of S3. The HEI fit within the innovation system i.e. the organisational and policy context within which they operate, their geographical scope and location, as well as their alignment with S3 objectives result in diverse levels, types and themes for engagement.

The multidisciplinary nature of HEIs means they bring capacity to contribute to S3 across its different priority areas and functions, ranging from scientists in S3 priority areas, experts in monitoring and evaluation to HEI managers acting as stakeholders, i.e. potential beneficiaries of S3-related funding. However, it is through the creation of human capital in local HEIs and the capacities and skills of HEI students that HEIs can potentially make the greatest contribution to S3 design and implementation and hence to regional development and growth.

CHAPTER 1:

INTRODUCTION TO HIGHER EDUCATION INSTITUTIONS AND SMART SPECIALISATION

Higher Education Institutions (HEIs)[2] have the potential to play a key role in regional transformation through their contribution to smart specialisation (S3), which is central to the implementation of EU Cohesion Policy. The smart specialisation concept was introduced in the 2014-2020 programming period to prioritise investment in areas where countries and regions had the most potential for knowledge-based development, selected on the basis of intelligence generated by the local innovation system. This 'Entrepreneurial Discovery Process' (EDP) would be continuous, with stakeholders engaged not only in the identification of investment priorities but also in their implementation.

Smart specialisation is an evolving concept, and the policy approach is maturing substantially. The 2021-2027 programming period represents a new phase for smart specialisation, with a revised framework regulating the European Structural and Investment Funds (ESIF) that incorporates a new enabling condition for the good governance of smart specialisation. The condition incorporates a set of seven fulfilment criteria aimed at enhancing the refinement and implementation of S3.

The recognition of human capital as a key driver of smart specialisation has led to the European Commission proposing a new specific objective for the European Regional Development Fund 2021-2027 to invest in 'Skills for smart specialisation, industrial transition and entrepreneurship'[3]. This investment in human capital and development of partnerships between HEIs and regional authorities orchestrating S3 will help HEIs to contribute to their regions' green and digital transitions.

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2   The term Higher Education Institution (HEI) is used to include universities as well as all other institutions that provide education from undergraduate level. The terms university and HEI are sometimes used interchangeably.

3   REGULATION (EU) 2021/1058 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund.

━━━ BOX 1.1

FULFILMENT CRITERIA FOR THE ENABLING CONDITION GOOD GOVERNANCE OF NATIONAL OR REGIONAL SMART SPECIALISATION STRATEGY (TEXT FROM THE COMMON PROVISIONS REGULATION 2021–2027)[4]

Smart specialisation strategy or strategies shall be supported by:

1. Up-to-date analysis of challenges for innovation diffusion and digitalisation.
2. Existence of competent regional or national institution or body, responsible for the management of the smart specialisation strategy.
3. Monitoring and evaluation tools to measure performance towards the objectives of the strategy.
4. Functioning of stakeholder co-operation ("entrepreneurial discovery process").
5. Actions necessary to improve national or regional research and innovation systems, where relevant.
6. Where relevant, actions to support industrial transition.
7. Measures for enhancing cooperation with partners outside a given Member State in priority areas supported by the smart specialisation strategy.

THE EVOLVING ROLES OF HIGHER EDUCATION INSTITUTIONS

The primary purpose of HEIs is education/teaching and research, with the specific balance and linkages across the two varying according to the individual institution. Publicly funded education is monitored through indicators such as the completion of degree programmes, student satisfaction surveys and postgraduate employment outcomes. Meanwhile, university and academic research-performance is assessed

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4   REGULATION (EU) 2021/1060 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy.

by papers published in peer-reviewed journals and frequency of citation. These are used to inform global rankings of universities which can help attracting international students and leading scholars.

A positive reputation for teaching and research can raise the profile of the region and lead to direct local impacts through student numbers and the role of the institution as a local employer.

It is increasingly common for governments funding higher education to require HEIs to have a 'third mission' serving the public good. This can be broadly defined as engagement with business and the community, i.e. improved business performance through research links, employment of skilled graduates and the establishment of spin off businesses by researchers and graduates. However, this 'third mission' seldom makes specific reference to urban and regional development, despite the fact that HEIs could play a transformative role through engagement in a regional innovation eco-system.

Recent drivers, such as smart specialisation, demonstrate that HEIs can contribute to the challenges facing civil society both locally as well as globally and contribute to economic, social and environmental place-based development. Addressing societal challenges requires building capacity for collaboration by diverse actors coming together in 'quadruple helix' partnerships embracing HEIs, business, public authorities and civil society.

Whilst the process of designing and implementing S3 has produced a positive change in the governance of innovation policy in many territories[5], human capital has been neglected. HEIs have a lot to contribute, not only in the development of the quadruple helix partnerships, but also in relation to skills for innovation. However, their capacities, challenges and incentives vary substantially and hence so do the contributions they can make to the design and implementation of S3. There is a need to tailor the contribution of HEIs to place-based approaches to regional innovation and growth according to their specific regional setting and strategic objectives.

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5   Edwards et al (2017) Higher Education for Smart Specialisation: Towards Strategic Partnerships for Innovation. Luxembourg: Publications Office of the European Union

CHAPTER 2:

ENGAGING WITH HIGHER EDUCATION

There are a number of drivers and trends shaping the behaviour of universities and other higher education institutions (HEIs) and their engagement with smart specialisation. Recent decades have seen tremendous transformation in HE. Across Europe, expanding HEI participation or 'massification' has occurred since 2000 with the proportion of people aged 30 to 34 with a tertiary qualification rising from 22.4% in 2000 (EU 27) to 40% in 2017 (EU28), in line with the *Europe 2020* target (although the proportion of women was 45% and the proportion of men only 35%)[6]. From 11 million tertiary education students in 1992, there were 20 million in 2018, of which more than 60% were undertaking a bachelor's degree. While attention so far has primarily focused on widening participation amongst 18-22-year-olds, future demand will come increasingly from under-served sections of society, such as low-income, socio-economically disadvantaged, migrants and refugees, mature students and life-long learners,[7] and from increasing internationalisation.

Student mobility and internationalisation has similarly changed the face of Europe's education system. Internationally, the number of students studying in other countries has risen from about 0.8m in the 1970s to over 5.3m in 2017; approximately 25% are doctoral level STEM (science, technology, engineering and mathematics) students[8]. The EU Erasmus programme and its successor, Erasmus+, have supported more than ten million European students to study, train and gain experience abroad since 1987[9].

In terms of HEIs in the European Research Area (ERA), around half of

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6   https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20190124-1

7   In the US, the "post-traditional" student, those over 22 years, has become the dominant component of the tertiary population; in Europe by contrast, adult participation in formal learning stood at only 10.8% in 2016 (U.S. Department of Education (2016) European Commission (2017b)).

8   https://migrationdataportal.org/themes/international-students#:~:text=the%20three%20definitions.-,Key%20Trends,Germany%20and%20the%20Russian%20Federation

9   https://europeancommission.medium.com/10-things-you-didnt-know-about-erasmus-41bb2c8ebd9c#:~:text=2.,train%20under%20the%20Erasmus%2B%20umbrella

the 2,465 in existence in 2018 were founded after 1970[10]. As HEIs have increased, they have become more diversified but also more hierarchically stratified. The core of Europe's research activity is conducted in 365 highly ranked or "world-class" research universities established before the 20th Century. Rankings emphasize research and international reputation and do not tend to reflect regional commitment, including research in the national language or the contribution a university makes to its community or local economy[11].

Since 2000, most newly established HEIs are private and these "alternative providers" or "independent sector" now account for 27% of all HEIs in Europe, although this varies at national level from between 5% and 50%[12]. Definitions vary as does their proliferation depending on national differences in education systems[13], but they tend to be smaller, more specialised, more regionally concentrated, and are more likely to focus on teaching than research.

BOX 2.1:

MULTI CAMPUS UNIVERSITY CONSORTIA IN FINLAND

One of the first countries to create a multi-campus HEI network was Finland, which since the 2000s has embraced the concepts of collaboration and mergers among HEIs. The emergence of university consortia with satellites in less developed regions enables the provision of adult education as well as research activities, enhancing the demand for scientific knowledge among the region's workforce. Furthermore, research tends to be focused on the needs of SMEs, with regional stakeholders playing an influential role in the governance structures. In 2013, the six university consortia had an annual turnover of 11 million euros, directly employed 130 people and had 2,400 students.

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10   European Tertiary Education Register (ETER) website: https://www.eter-project.com/

11   With the exception of U-Multirank, which has been developed with support from the European Commission: https://www.umultirank.org/

12   Data on new HEI formation available on the ETER website: https://www.eter-project.com/

13   Definitions depend for example on distinctions between non-profit and for-profit, the extent to which institutions are in receipt of recurrent public funding for teaching and research. Whilst they still have to meet accreditation standards, private HE can often operate outside national governance and monitoring arrangements due to their size or status.

FROM THE DIGITAL TRANSITION TO INDUSTRY 5.0

Industry 4.0 (digitalisation and AI-driven technologies for increasing the efficiency and flexibility of production) and Industry 5.0 (research and innovation as the driver of the transition to a sustainable, human-centric and resilient European industry) are set to have far-reaching implications for the nature of work and employment, as well as where and how people live. Most new jobs will be in knowledge- and skill-intensive occupations, such as high-level managerial and technical jobs. Workers will need to be far more flexible and adaptable in their careers and engage in continual upskilling, especially in digital skills.

While successful industrial transitions may rely on the confluence of a variety of policy areas, targeted provision of education and training is one of the most important to address. Public investment has a role to guarantee the provision of adequate human capital and availability of appropriate skills and competences where they are most needed.

Vocational education, training and adult learning can address demographic challenges in regions going through industrial transition and counteract the negative consequences of unemployment and globalisation.[14]

──── BOX 2.2:

DUAL EDUCATION AND TRAINING SYSTEM IN GERMANY[15]

Germany is one of the leading countries in developing qualifications that integrate further education with on-the-job training, referred to as Dual Degrees. Training in the form of apprenticeships is provided mostly by Small and Medium Enterprises and further education by Universities of Applied Sciences (Fachhochschule). The system is regulated by law and is supported by strong cooperation between the federal government, the state governments and employers. Common standards in accreditation, assessment and qualifications provide certainty for employers about

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14   Pontikakis, D. et al (2020) Projecting Opportunities for INdustrial Transitions (POINT): Concepts, rationales and methodological guidelines for territorial reviews of industrial transition.

15   See: http://aei.pitt.edu/74021/1/Germanys_dual_vocational_training_system.pdf

staff competences and reduce recruitment costs, while for employees it provides a more secure career path. Due in part to the dual approach, youth unemployment in Germany is one of the lowest in Europe. Furthermore, the cooperation between government, education providers and business enables a more integrated response to new challenges and the digital revolution.

Industrial transition has obvious implications for higher education, with increasing demand for a wider range of competences, better "soft skills", as well as continuing access to a wider range of education and training opportunities. Digitalisation has a transformative impact on the overall learning experience and on HEIs, changing the way courses are delivered to students when attendance in person may be problematic. The COVID-19 epidemic has meant that students are increasingly looking for local options, which can create new opportunities for universities to link with their local communities.[16] HEIs need to be increasingly flexible in how they develop and deliver education and training, enable students to tailor their experience to their needs and in the design of campuses and buildings (see Box 2.1). Internships and new apprenticeship systems can bridge training from HEIs to firms (see Box 2.2) and credit-accumulation based systems – such as the European Credit Transfer System (ECTS) – can enable students to study flexibly over different programmes, timeframes, and locations. Other career preparation programmes exist that offer non-formal and informal diplomas, certificates and professional examinations that support adult, part-time and mobile learners such as competency-based education (CBE).

SPATIAL DISTRIBUTION, MISSION AND IMPACT

The Renewed Agenda for Higher Education[17] calls on HEIs to better adapt to new challenges at regional level by taking into account the needs of the labour market and by engaging more intensively with public, private and non-governmental entities. Numerous studies show an intensification of industry-academia relations in the past twenty years, in response to public budgetary constraints and increasing pressure for

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16   https://www.oecd.org/coronavirus/policy-responses/the-impact-of-covid-19-on-student-equity-and-inclusion-supporting-vulnerable-students-during-school-closures-and-school-re-openings-d593b5c8/

17   European Commission (2011).

HEIs to prove their public value. Smart specialisation offers a means to integrate higher education into regional development policies. However, differences among HEIs and higher education systems, each with their own regulatory arrangements, missions and priorities, suggests varying contributions to regional strategies.

The location and typology of HEIs influences student access and participation, investment, talent growth, and business and societal collaboration. HEIs tend to be located in large urban areas and capital cities, especially those awarding PhDs, while Universities of Applied Science (UAS) are more likely to be located in smaller towns and are more prevalent as a model in the Netherlands, Germany, Austria or Finland. UAS often originated as local colleges or institutes with a mission linked to employability and collaboration with enterprise and hence tend to demonstrate much stronger cooperation with regional governments and employers. Contributing to regional development is often explicitly incorporated into their study programmes and hiring practices[18]. In contrast, research universities are more academically and theoretically focused, and are increasingly trans-national and international, forming partnerships with universities in other countries for educational and research purposes, and attracting students, academics and professionals from around the world. The dichotomy of competing internationally while remaining engaged with their regional innovation ecosystems and engaged with their community is challenging. In the context of S3 and the generation of common long-term agendas for sustainability and recovery, the spatial distribution of different types of HEIs is therefore highly relevant. HEIs may not exist in peripheral regions where there is a need for both human capital and RDI.

The potential regional innovation impact of HEIs can be assessed through the HEInnovate[19] tool and the Regional Innovation Impact Assessment (RIIA) Framework[20] (see Box 2.3).

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18   European Training Foundation (2013)

19   www.heinnovate.eu

20   Tijssen et al. (2021)

BOX 2.3:

REGIONAL INNOVATION IMPACT TOOLS FOR HEI

HEINNOVATE: INNOVATION AND ENTREPRENEUR FRAMEWORK FOR HEI

HEInnovate is a European Commission initiative developed in collaboration with the OECD. It is a guiding framework for higher education institutions who wish to explore their innovative potential. HEInnovate diagnoses areas of strengths and weaknesses in eight key areas, opens up discussion and debate on the entrepreneurial / innovative nature of an institution and enables comparative analysis of evolution over time.

REGIONAL INNOVATION IMPACT ASSESSMENT (RIIA) FRAMEWORK

The framework has been tried and tested among 20 universities in Europe. RIIA analysis combines internal and external factors: how 'society, economy and environment' drive and interact with 'policies, programmes, projects and people' within HEIs. Whether or not HEIs have already produced regional impacts is not RIIA's key concern; the focus is on the enhancement of their innovation potential through dedicated resource capacity building.

RIIA applies a 'narrative with numbers' methodology, combining contextualised qualitative information with targeted quantitative data. While existing impact analytics tend to focus exclusively on knowledge exploitation activities and innovative outputs, the RII approach analyses the regional impact potential of HEIs in a broader sense, integrating different elements of the knowledge triangle (research, education and enterprise).

However, territorial and economic engagement, such as those required by S3, even when recognised in HEIs' strategic plans and formally acknowledged as part of their missions, do not tend to be significantly rewarded in the recruitment and promotion of academics. Most European HEIs lack formal recognition and reward systems for individual academics that cooperate with industry and other external partners and have limited opportunities and incentives to engage in activities

beyond research and teaching.

Engaging HEIs and academics, especially from traditional universities, in S3 can therefore be a challenge. If academics are to contribute to regional development as part of their career, their performance assessment should value such activities whilst an appropriate policy mix or set of instruments should be in place to enable them to engage and to facilitate career paths outside academia. From the 2000s several OECD countries have introduced new measures or created bodies to promote and reward university-industry linkages, R&D funds mobilized from private sources, earnings from consulting, income from patent licensing, and participation in spin-offs or start-ups. Policies supporting academic research linked to territorial demands and S3 priorities, through industrial PhDs, collaborative research grants and hybrid work models have increasingly been developed (see Box 2.4).

BOX 2.4:

ACADEMIC PARTICIPATION IN S3

VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS: NEW PERFORMANCE FRAMEWORKS

Vienna University of Economics and Business developed a performance assessment method for staff appraisal that recognises activities such as work in university management or decision-making bodies, committee membership, work with regional authorities, active co-operation with external partners and knowledge transfer.

THE LEAD INSTITUTIONS INITIATIVE IN AUSTRIA

Austria's Lead Institutions Initiative aims to position HEIs as pro-active leaders in regional development by integrating their different activities in the so-called knowledge triangle (education, research and innovation) and increasing their contribution to regional innovation priorities set out in their smart specialisation strategies. It uses performance-based funding agreements in which strategic targets for increased cooperation form the basis for funding allocations.

UNIVERSITY OF GIRONA: SECTORIAL CAMPUSES

The Sectorial Campuses of the University of Girona (UdG) aim to proactively support and develop relationships between companies

and institutions in a given socio-economic sector and the University of Girona. They have been established in areas of strength of the university, namely: Water, Tourism, Agrofood/Gastronomy, Cultural and Corporate Communication, Health, Cultural and Natural Heritage and Composite/Compound Materials. They lift much of the administrative burden of third mission activities from the individual academics as they broker the needs and interests of the companies and institutions of each sector and match them with the relevant university researchers.

LOWER AUSTRIA – ATTRACTING TALENT THROUGH STRATEGIC INVESTMENT IN HEI.

Over recent decades, Lower Austria has been through a transition from a largely agricultural economy to a knowledge region[21]. One of the factors in this successful transition has been the strategic investment in higher education following the adoption of a strategy in 2011. Funding for Universities of Applied Science (UAS) and the private Donau-Universität Krems, which cater exclusively for professional development and lifelong learning, has been increased, leading to a doubling of student numbers since 2009 and the provision of human capital for Lower Austria's new knowledge-based industries. National funding has also been provided for universities to set up research centres in Lower Austria, resulting in knowledge spill-overs into regional firms.

To sustainably engage HEIs in S3, public policies need to take into account the challenges and incentives of the research profession, re-think performance-assessment frameworks and to devise appropriate policy instruments and mixes that promote engagement. Even in regions without traditionally strong higher education sectors, innovative support to HEIs within and outside the region can help build human capital that contributes to regional economic development and industrial transition.

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21   Reichert, S. and Edwards, J.H., 2021, Higher Education and Smart Specialisation in Lower Austria, Publications Office of the European Union, Luxembourg

CHAPTER 3:

HIGHER EDUCATION INSTITUTIONS AND S3 GOVERNANCE

S3 has opened the process of policy making to other actors, facilitating the engagement of entrepreneurial and knowledge-creating actors. S3 governance should aim to achieve well-balanced representation of stakeholders and to ensure distributed leadership, co-ownership and long-term commitment for the identification and implementation of S3 priorities.

However, the S3 governance system is highly context-specific, and governance arrangements should reflect local specificities. HEIs should be involved in the early definition of the S3 governance structures to ensure a meaningful and coordinated contribution across the three HEI missions (research, teaching and outreach/community) and S3 governance levels (strategic, technical and bottom up).

S3 GOVERNANCE PARTICIPATION

Top-level strategic governance of S3 should involve different government departments and other key organisations, including HEIs. This facilitates a broader consensus on S3, with the possibility to engage more widely with stakeholders. However, it may entail some redefinition of decision-making structures and processes as well as some change in operational culture. In regions with weaker administrative capacities and innovation systems, the leadership of higher education can be fundamental to leverage regional capacities, integrate national-regional governance and connect to international networks.

BOX 3.1:

S3 HORIZONTAL COORDINATION AND INVOLVEMENT OF HEI

BASQUE COUNTRY

The early stages of developing the Basque Country S3 were led by the Government Department of Competitiveness and Economic Development and SPRI[22]. An Operational Working Group reporting directly to the Presidency Department was set up to take over the S3 process, moving from a single department leadership to a distributed leadership with multiple government departments. Orkestra[23] had built a solid relationship with the department but needed to redefine their position in this new governance space to maintain their active participation in the construction of the new governance arrangements[24].

EASTERN MACEDONIA AND THRACE

The Democritus University of Thrace is participating actively in the HEInnovate Greece country review, with the opportunity to self-assess their entrepreneurial and innovation capacity and learn from peer HEIs in Greece and internationally. However, whilst the local HEIs/PROs have been relatively successful in participating in national collaborative research projects and research infrastructures, the region would benefit from a stronger leadership of HEIs to define a vision and strategy on their role in regional development (Tolias and Arregui-Pabollet, 2021). S3 is generally considered by regional stakeholders the best available tool to develop a long-term, evidence and place-based regional innovation strategy in the region.

Multiple policy levels (regional, sub-regional, national and EU) are responsible for research and innovation policy and relevant to S3. Multi-actor involvement across the quadruple helix (science, policy, industry, and society) challenges previous decision-making arrangements,

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22   SPRI is the Basque Industrial Development Agency under the Competitiveness and Economic Development Department of the Government

23   Orkestra is a research institute attached to the University of Deusto, a private university based in the Basque Country

24   Aranguren, M-J., Morgan, K. and Wilson, J. (2016). Implementing RIS3. The case of the Basque Country. San Sebastian: Orkestra reports.

highlighting the need to coordinate measures and funding across political levels and to create and connect spaces where entrepreneurial discovery might occur. Technical/managerial level coordination should be established that ensures S3 project implementation and bottom-up mechanisms such as working groups should be in place to enable local actors and end-users to participate and inform the S3 process.

—— BOX 3.2:

GIPUZKOA: MULTI-LEVEL GOVERNANCE

The province of Gipuzkoa (Basque Country) developed an Industry 4.0. programme for SMEs through an action-research collaborative multilevel approach. The process was based on *reflection and action cycles* developed between researchers and various directors of the council, (civil servants), mayors and directors of county agencies. Workshops were organised to encourage cross-partner learning, understanding and collaboration.

ENGAGING HEI ACTORS IN S3 GOVERNANCE

A range of actors within the higher education community (entrepreneurs, managers and researchers) can contribute to S3 governance levels, playing different roles and bringing complementary expertise.

Individual researchers can engage in an entrepreneurial co-generative role in collaboration with other regional stakeholders. This can be encouraged through the introduction of organisational measures or internal incentives, for example through measures for closer university-business collaborations or the use of action-oriented participatory processes to co-construct solutions to solve specific challenges.

BOX 3.3:

UNIVERSITY ENGAGEMENT IN S3

NAVARRA

The Public University of Navarre (UPNA) has established research institutes aligned with S3 priorities to engage the research community in S3 governance, particularly in sectorial groups and thematic clusters. It aims to increase university integration and coordination with the productive fabric of the region and enable stronger collaboration in S3 fields. UPNA's Rectors and Vice-Rectors are engaged in and contribute to S3 definition and implementation. As a result, education has been included as a transversal S3 priority, whilst the UPNA has integrated S3 in the core of the Strategic Plan 2020-2023[25] to ensure the curriculum offered responds to S3.

LOWER AUSTRIA

In Lower Austria close cooperation exists between the state government department responsible for the region's economic strategy and S3 and the department for science and research. Additionally, a steering group brings together the main actors involved in the region's S3 implementation, particularly intermediaries between HEIs and industry, such as the regionally-funded technopoles and clusters. A regional "Site Forum" assembles representatives of the region's HEIs to develop new ideas, discuss strategic developments and suggest new thematic areas, policies or instruments. Finally, the state government has attempted to implement its regional strategies in close synergy with federal level policies, in particular those for research and higher education. This has mainly been channelled through a governance body called "STRAT.AT 2020 Partnership", which was created during the design of Austria's ESIF Partnership Agreement to encourage wider dialogue and synergy between national and regional innovation policies that involve HEIs.

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25 https://www2.unavarra.es/gesadj/seccionActualidad/plan-estrategico/Plan_Estregico_2020_CASTELLANO.pdf

Managers – The involvement of the highest levels of the university hierarchy, such as Rectors or Vice-rectors, will bring a more coordinated approach to regional challenges from the three university missions and ensure education is a key element of the strategy. Being active members in the strategic governance levels will also help integrate S3 into the institutions' agenda.

EVOLUTION OF S3 GOVERNANCE

The development of S3 governance arrangements is a continuous process contributing to the development and evolution of a shared vision. Governance arrangements are unique: the ways in which different actors participate in the definition of governance arrangements may determine how they contribute to territorial development. S3 brings a different approach to policy making and to the role of HEIs and S3 benefits from the involvement of the broader university community, their research capacity, knowledge collaborations, international networks and innovation dynamics. Different university profiles and incentives will influence their role and contributions.

S3 governance arrangements can be enriched by *experimental governance*: an on-going learning process in which public authorities recognise their limited knowledge of the implementation context and define policy objectives as an iterative process in cooperation with multiple R&I actors[26]. This can facilitate the legitimation of different stakeholders' voices in the S3 governance system and ensure their ownership of S3.

26   Radosevic, S., Curaj, A., Gheorghiu, R., Andreescu, L., & Wade, I. (Eds.). (2017). Advances in the theory and practice of smart specialization. Academic Press.

CHAPTER 4:

HE AND THE ENTREPRENEURIAL DISCOVERY PROCESS

INTRODUCTION

The Entrepreneurial Discovery Process (EDP) centres on the identification, refinement or review of regional S3 priorities, through the mobilisation of various actors in the identification and exploitation of innovation opportunities throughout the design and implementation of the S3 strategy. The EDP is an inclusive, interactive and evidence-based bottom-up process that relies on stakeholder engagement and the sharing of knowledge distributed across sectors, actors and users. EDP must be a continuous activity in which stakeholders remain involved in the refinement and monitoring of priority areas throughout the implementation of the strategy.

THE INVOLVEMENT OF HEI IN THE ENTREPRENEURIAL DISCOVERY PROCESS

HEIs are an important component of the knowledge economy and can be key actors in a reinforced EDP in 2021-2027 that looks to discover new growth pathways and promote transitions towards sustainable and inclusive industrial transitions. HEIs are the stakeholders most likely to be invited to engage in the EDP and the most likely to participate. Care needs to be taken that they are not over-represented in relation to other entrepreneurial stakeholders that may be more difficult to mobilise (e.g. SMEs).

Nevertheless, HEIs might resemble federations of multiple actors rather than a single institution: faculties, departments and university institutes are often powerful entities with distinct cultures. Additionally, they operate under tight institutional and administrative environments and may have limited flexibility to (quickly) adapt governance mechanisms, reorient thematic and funding priorities or innovate in the education portfolio. HEI engagement and commitment to the EDP will depend on the profile of the institution and their fit within the innovation system.

MAPPING THE INNOVATION ECOSYSTEM

Mapping the innovation ecosystem enables the identification of current and emerging themes, actors, networks, structures and collaborative communities. It is an important first step in the EDP to ensure the widest participation. An institutional analysis of each HEI in the regional system, the organisational and policy context they operate in, and their respective missions alongside the identification of themes and collaborations can provide an assessment of strengths and weaknesses of higher education and the innovation ecosystem, and institutional diversity in terms of organisation, people and themes relevant for S3 and the EDP. Academic and functional units or individuals that work on topics related to S3 priorities should be engaged alongside senior managers.

Relevant sources of data on HEIs include project databases (for EU, national or regional projects), bibliometrics and altmetrics, patents, clinical trials, and corporate sources such as strategic plans, priority areas, the composition of the student body (undergraduate, Masters and PhD students), the educational portfolio, data on student placement and careers, start-up/spin-off registers and labels awarded to research or training entities or intermediary structures (e.g. innovation hubs, science and technology parks and clusters) (see Annex I). An analysis of existing networks and trends is possible through mapping collaboration patterns in competitive projects and co-publications, potentially supporting the identification of emerging priority areas.

▬▬ BOX 4.1:

EDP AND INDUSTRY 4.0 IN TUSCANY, ITALY[27]

In accordance with the National Plan Industry 4.0, the Department of Industry of Regione Toscana EDP activities resulted in the creation of the Regional Platform for Industry 4.0, an integrated structure aimed at connecting the needs of private companies to Industry 4.0 competences offered by local HEIs and research institutes. As Industry 4.0 has no standard definition or perimeter, the initial objectives of the platform were to characterise the prevalent regional topics connected to Industry

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27   http://www.cantieri40.it/i40

4.0 and to identify the corresponding individual experts (researchers, technicians) in the regional HEIs and research institutes. A double, interconnected, methodology was developed:

— Qualitative definition of the boundaries of Industry 4.0 and launching of a survey of local HEIs and research institutes to map researchers and their areas of competences (according to the specifications of the National Plan)
— Implementation of natural language processing and machine learning (topic modelling) techniques to automatically identify and characterise a large number of scientific publications, and consequently, regional researchers, in Industry 4.0 topics.

Of 8.000 researchers and 50.000 publications in the region, 2.000 researchers were found to contribute to 20 Industry 4.0 subtopics. The Platform contacted them directly, and more than 1.000 agreed to join the expert database of the Regional Platform for Industry 4.0. Furthermore, 230 private companies were identified in the process and classified according to their topics of interest. In an open innovation framework, the Regional Platform is now supporting matching and technology transfer activities amongst these actors, enabling the process of entrepreneurial discovery.

A rough taxonomy of HEIs should be developed that allows the public administration to understand how each institution can best contribute to the EDP. Mapping HEIs policy framework and strategic, financial, thematic and hiring autonomy, orientations and practices will enable policy-makers to gauge their interests and capacities.

HIGHER EDUCATION AND THE EDP: MULTI-FACETED ENGAGEMENT

The analysis should provide a first list of suitable HEIs, departments/faculties, units and individuals to contact, and mobilise, on the basis of the pertinence of their work and capabilities for potential S3 priorities and their position as a strategic actor in the institutional landscape. HEIs can contribute across different missions, activities and disciplines: through their teaching, research and technology transfer activities and across different disciplines, including social sciences, arts and humanities.

EDUCATION AND THE EDP

With the increasing importance of life-long learning in the knowledge economy, HEIs have a crucial role in supporting upskilling and reskilling towards the techno-economic areas of opportunity defined in the S3, and students can be a resource to prepare for and involve in the EDP.

▬▬ BOX 4.2:

ENGAGING STUDENTS IN EDP

Saxion university of Applied Science (The Netherlands) is an international-oriented university of applied science that trains students to bridge the gap between technology and application. A Smart Solutions Semester gives students, lecturers, researchers, companies, governments and NGOs the opportunity to collaborate and conduct projects in inter-professional and international teams. Currently, more than 550 students are working in groups of six to eight on around 100 real-life assignments, assisted by a coach and in close collaboration with the partners.[28]

Within the context of the Wine Lab knowledge alliance, the **University of Macerata** (Marche, Italy) organised an annual International Student Competition on "Place branding and Mediterranean Diet" in which students engaged with local entrepreneurs to work on challenges.[29] The competition was organised in collaboration with a local NGO (Laboratorio Piceno della Dieta Mediterranea) and municipalities, and comprised lectures with international speakers, study visits to firms, workshops and interviews with entrepreneurs. At the end of the programme students provided the businesses and municipalities with a proposed solution.

RESEARCH AND THE EDP

Scientists engaged in **fundamental research** can stimulate a reflection on longer-term priority-setting and related human resources and technological capacities within the EDP. In less-developed innovation systems, they are usually an essential source of international inflows

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28   http://www.saxion.nl/smartsolutions

29   http://www.laboratoriodietamediterranea.it/it/international-student-competition-2019

of talent and funding, and a lever for regional positioning, marketing and communication. However, EDP intervention may be ad hoc, rather than continuous.

Applied researchers with experience in technology transfer, collaboration with the private sector and entrepreneurial activities should be identified, alongside their networks of innovative companies.

HEI engagement in EDP, S3 and third mission activities is often conceived narrowly and in relation to STEM subjects, yet multi-disciplinary inputs, including those from social sciences, arts and humanities can provide the economic and social analysis necessary for understanding and framing socio-economic needs, and co-defining solutions to challenges. Cultural and experience-based industries (such as media or tourism), particularly in combination with digital technologies, can co-create innovative specialisation domains. New tools, profiles and methods of engagement can yield significant impact, for example, in social innovation.

SUSTAINING HEI PARTICIPATION IN A CONTINUOUS EDP

As with all participatory processes, continuous EDP can only be sustained where it provides returns to stakeholders for their investment, for example through providing a forum to comment on, and add to, the latest monitoring results and to collectively anticipate trends and changes in the environment. HEI participation will ensure the development of a level of entrepreneurial and innovation readiness distributed across functions, missions and departments, a common vocabulary with other stakeholders and a common understanding of the policy process.

━━ BOX 4.3:

NORTH EAST ROMANIA – BUILDING S3 CAPACITY THROUGH THE EDP[30]

Universities played an active role in the regional EDP in North East Romania, participating in bottom-up, interactive and inclusive focus-groups for representatives of the regional quadruple helix from the six S3 priority areas. The exercises undertaken aimed at identifying directions for regional development through smart specialisation, main societal challenges for the region, and innovative solutions for development at local, sectoral and cross-sectoral level. 129 project ideas aligned to S3 were submitted for development, of which 22 were directly submitted by universities and 47 had universities as project partners. A second round of project ideas launched in 2018 resulted in 39 extended project ideas, out of which 15 were promoted by the universities and 13 had universities as partners. Subsequently, the Regional Development Agency has embedded HEI management and researchers in the S3 governance structure.

Engaging HEIs in the EDP requires mapping the local HE system, as HEI engagement and contribution across different activities and disciplines will vary significantly depending on their profile (research, teaching or third mission activities). HEI contribution may also require capacity building, as HEIs develop an understanding of S3 process, policies and their individual/institutional role within them.

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30   http://s3platform.jrc.ec.europa.eu/-/higher-education-for-smart-specialisation-the-case-of-north-east-romania

CHAPTER 5:
FUNDING INSTRUMENTS FOR HIGHER EDUCATION INSTITUTIONS

Achieving S3 objectives largely depends on the design and co-creation of good funding instruments that match stakeholders' (including HEIs) capacities with regional R&I and education needs. Funding instruments targeting HEIs and aligned to their incentives and ambitions lead to their stronger engagement in territorial development.

HEI INCENTIVES AND DRIVERS

HEIs can be very diverse in their objectives, ambitions and geographical scope, as well as their alignment with S3 objectives. While some may be meaningfully "place-based" others may be more national or internationally oriented. Therefore, in designing successful funding instruments and successful S3 collaboration, it is necessary to understand each HEI's scope of action and identify their drivers:

— *Research-intensive institutions with strong international academic visibility* are driven by international academic recognition, rankings, bibliometric indicators, awards and prestigious grants. They contribute to the dynamism of the region as a whole, but their research might nonetheless be difficult to reconcile with local thematic priorities. Nevertheless, such institutions can contribute to the advancement of their region, its international positioning, attractiveness and the development of R&D intensive fields.

— *R&D and technically oriented institutions with a strong network of industry partners from the region and outside* are incentivised by collaborative research and education. They combine research activities, graduate training and knowledge transfer, supporting R&D regionally and more widely.

— *Universities with a regional outlook in their research and education activities* will target mostly local students and be more inclined

to look for an association with local business or government departments to facilitate graduates' entry in the labour market through, for example, business traineeships, industrial PhDs, educational innovation and technology transfer.

— *Higher education vocational institutions*, which offer tailored education and training adapted to local human capital needs. Collaboration with local companies and both public and private stakeholders is their main driving force, as well as attracting students.

An important consideration is whether funding instruments support specific organisations or R&D activities in general. Unexpected complications may arise, for example, it may be necessary to support collaborations with HEIs outside the region to develop the local R&D system, hence directing public resources to non-regional actors.

FUNDING INSTRUMENTS: SOURCE AND TYPOLOGY

Funding instruments targeting HEIs are diverse in scale and typology, ranging from single researcher grants, networking instruments, infrastructure investments, social innovation activities or technology parks, reflecting a diversity of objectives, actions and project type.

Funding framework participation differs substantially across HEIs, with varying opportunities as a result for regional administrations to intervene and orient HEI activity.

NATIONAL/REGIONAL FUNDING INSTRUMENTS: CORE AND COMPETITIVE FUNDING

National and regional government are key funders of HEIs, both through core funding and competitive funding calls.

— *Core funding* configuration, management and level of centralisation is extremely variable and will influence the shape of incentives. For example, multi-annual financial frameworks make it easier to introduce long-term objectives and programmes. Result and impact targets can also promote collaborative or multi-disciplinary research, university-business collaborations and internationalisation.

— *Competitive calls* stimulate HEIs' contribution to regional or national

challenges and contribute to strengthen the R&I system. These calls promote R&I collaborative projects, build international networks and strengthen capacity to participate in EU platforms and projects.

The level of dependency of HEIs on such schemes is usually high.

EUROPEAN STRUCTURAL AND INVESTMENT FUNDS (ESIF)

ESIF constitute the most important EU funding instrument to tackle socio-economic disparities within the European Union, through a number of shared management funds[31]:

— European Regional Development Fund (ERDF)
— European Social Fund Plus (ESF+)
— Cohesion Fund (CF)
— European Agricultural Fund for Rural Development (EAFRD)
— European Maritime and Fisheries Fund (EMFF)
— Just Transition Fund (JTF)

In the 2014-2020 programming period, HEIs were among the main beneficiaries of ERDF calls under Thematic Objective 1 for research and innovation projects, technology transfer or collaborative partnerships with business. ESF support to human capital for innovation received a lower level of funding and tended to be very unevenly distributed across the EU. Operational Programmes could however be multi-fund which enabled research and education to be addressed in a more integrated way across the ERDF and ESF portfolios. Synergies across and between European Structural and Investment Funds (ESIF) and other funding instruments are encouraged to strengthen the R&I system and the impacts of investment.

EUROPEAN COMPETITIVE FUNDING INSTRUMENTS:

The majority of EU centrally managed funding programmes tackle either research and innovation or education. The relevance and weight of this funding in individual HEIs varies depending on the type of institution, regional characteristics and elements such as previous experience and participation in international networks.

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31   https://ec.europa.eu/regional_policy/en/information/legislation/regulations/

Horizon 2020/Horizon Europe, is the main EU funding programme for research and innovation, allocating the funds through competitive calls for proposals targeting different type of beneficiaries. It encourages, especially in research-intensive HEIs, collaboration with other European stakeholders to overcome key EU challenges.

The **Marie Skłodowska-Curie Actions** provide grants for all stages of researchers' careers to encourage transnational, intersectoral and interdisciplinary mobility.[32]

The **EIT-Knowledge and Innovation Communities**[33] are partnerships that bring together businesses, research centres and universities to strengthen collaboration in the triangle of knowledge with the aim creating a favourable environment to promote innovative products and processes. As part of its Strategic Innovation Agenda for 2021-2027, the EIT will look to increase the regional impact of KICS through developing links to S3.

The **Erasmus+** programme is also an important source of HEI funding, shaping mobility, education innovation and networks.

Knowledge alliances (or **Alliances for Innovation** in the 2021-2027 Erasmus Programme) are transnational and result-driven activities between higher education institutions and businesses and are open to any discipline, sector and to cross-sectoral cooperation. They aim to develop new, innovative and multidisciplinary approaches to teaching and learning; stimulate entrepreneurship and entrepreneurial skills of higher education teaching staff and company staff; facilitate the exchange, flow and co-creation of knowledge..

Forward Looking Cooperation Partnerships are large-scale projects that aim to identify, develop, test and/or assess innovative approaches with the potential of becoming mainstream and improving education and training systems.

European Universities are transnational alliances that will become the universities of the future, promoting European values and identity, and revolutionising the quality and competitiveness of European higher education. A number of funded ongoing projects work specifically on aspects related to Higher Education in Smart Specialisation, such as

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32   https://ec.europa.eu/programmes/horizon2020/en/h2020-section/marie-sklodowska-curie-actions

33   https://eit.europa.eu/activities/innovation-communities

Re-Act and UasiMap[34].

OTHER FUNDING:

Finally, the last element of the picture is made of other funding coming from student fees, donations, established collaboration with industries, or agreements with other public or semi-public bodies (e.g. chambers of commercial, professional associations, etc.).

DEFINING FUNDING INSTRUMENTS FOR S3

The design of new instruments can facilitate missing connections and help steer activities in line with regional interests and determine the role and impact of HEIs in S3. The success of a funding instrument depends on the alignment between the instrument and the needs to be addressed which is a highly contextual and specific exercise. Needs should be identified through a co-design process with the potential beneficiaries and match S3 objectives with their needs ensuring they are reflected in the selection criteria.

In the first half of the 2014-2020 programming period, calls for proposals tended to address all the selected priorities within S3 and were not specific to one priority area (Gianelle & al., 2017). Topics that are defined too broadly however, risk scattering scarce resources, failing to achieve critical mass and becoming outdated in sectors where scientific knowledge advances quickly. Topics that are narrowly defined may be beneficial if the S3 priority area is dependent upon a critical mass of beneficiary organisations and/or costly infrastructure or equipment, and where EDP processes are mature, well-identified and advanced. Otherwise it may hinder emerging areas and create a lock-in effect.

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34   http://ris3heinnovate.eu/ and https://uasimap.eu/home

BOX 5.1:

FUNDING PRIORITIES AND APPROACHES UNDER ERDF

There are different approaches to funding research and innovation projects under ERDF.

In **Poland**[35] under the 2014-2020 programming period all such funding has been channelled through private firms, which may sub-contract HEIs to assist with research. The objective has been to focus investment on knowledge demand, but low levels of university-business cooperation has led to low participation by HEIs in ERDF, which have benefitted mainly in relation to education activities under ESF (mostly unrelated to regional priorities). HEI-based research in Poland could contribute more to its regional innovation ecosystem if better links could be created between universities and business.

In contrast, national and regional operational programmes in **Portugal**[36] have supported single beneficiary R&I projects in HEIs, with the ERDF being the most important source of research funding for many. While the projects should be linked to S3 priorities, the lack of firm participation means their results may not benefit the regional economy. Some HEIs in Portugal have also been involved in projects that require partnerships with firms as dual beneficiaries and the results suggest that this could be a better approach to incentivise HEIs to implement S3.

In **Lithuania**[37] investments in R&I infrastructures have doubled in 2014-2020 compared to the previous period, with significant investment to connect R&I infrastructures internationally. However, there is a need to boost the use of research infrastructures for joint research and business projects, as well as to strengthen international participation and the attraction of a critical mass of researchers. The long-term strategy "Lithuania 2030" looks to develop a favourable environment for

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35   https://ec.europa.eu/jrc/en/publication/higher-education-smart-specialisation-lubelskie-poland

36   https://publications.jrc.ec.europa.eu/repository/bitstream/JRC123230/jrc123230_hess_portugal_final_report.pdf

37   https://s3platform.jrc.ec.europa.eu/-/higher-education-for-smart-specialisation-the-case-of-lithuania?inheritRedirect=true

conducting research, the creation of world-class centres for studies and research and to enable HEI student mobility. Lithuania has partnered with other EU regions in the INNOHEIs[38] Interreg Europe funded project, to improve research and innovation infrastructure performance through peer learning collaborations.

In **Centre-Val de Loire**[39] LE STUDIUM is a regional agency that hires highly skilled international researchers to strengthen international scientific exchange and enhance the attractiveness of the Centre-Val de Loire region. The initiative has attracted more than 222 researchers from 47 countries, with 5% of researchers settling in the region after the end of the programme. Since 2013 LE STUDIUM is involved in the Ambition Recherche Development (ARD 2020)[40] initiative promoting international university-business collaborations. The aim is to attract researchers and stimulate their internationalisation through participation in H2020.

The following questions should be considered when defining a scheme:

— *Why* is the funding needed and what is the rationale for the inter-vention? What change needs to be bought about and what activity improved and supported (research, teaching, communication, etc.)?
— *What* is being funded? People and skills (salaries, project-based researchers or training for new skills); infrastructure and equipment; and/or networking and connections (international mobility, events, conferences, communication, meeting venues)?
— *How* it is being funded? The approach might vary between compet-itive calls or performance-based funding.
— *Who* should be involved? Are the beneficiaries likely to be individual researchers, research groups or institutions and will they be directly funded or benefit (in)directly from the intervention?

S3 funding instruments can tackle, for example:

— Employability, human resource needs and integrating life-long

38 https://www.interregeurope.eu/innoheis/

39 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC113844/jrc113844_hess_final_report_centre-_val_de_loire_final_en_check_final.pdf

40 https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/support-measure/ambition-research-and-development-ard-2020-0

learning into university curricula through funding academic staff and facilitating the involvement of local companies and entrepreneurs in education activities or curriculum design.

— Networking schemes between researchers and regional entrepreneurs, ensuring recognition of the participation of researchers in such collaboration.

— Business-academia cooperation: facilitating SME access to university knowledge and infrastructures through introducing vouchers to pay for specialised university services, funding hybrid business-academia organisations and student placements in companies.

— Intra-governmental cooperation and intra-university coordination between research, innovation and education activities, through facilitating collaboration hubs within and outside the university, enabling piloting facilities or multi-disciplinary research institutes.

Further considerations in the design of funding instruments are described below:

— *Interaction with beneficiaries is important in identifying topics and needs but also in designing a call*. Public administrations managing funds should have a good understanding of the constraints of varying beneficiaries. The design of a call can be tested before full roll-out to ensure it is user-friendly.

— *Continuity over time and the use of common templates and platforms* to answer calls for proposals.

— *Targeted communication to specialised HEI actors* with knowledge in collaborative projects, proposal drafting and preparation that select, filter and target the information to researchers.

— *A long-term perspective* and sustainability.

— *Regular monitoring of results* achieved by the funding instrument, in terms of type of beneficiaries mobilised, project characteristics or researchers attracted.

BOX 5.2:

CALL CO-CREATION

The Northern Netherlands Alliance (SNN), the ERDF Managing Authority, has encouraged regional HEIs and other R&I stakeholders to actively participate in the co-creation of funding streams. Their Open Innovation call is defined in terms of objectives to be achieved instead of specific activities or actions, providing a flexible framework within which to propose highly innovative and ambitious proposals.

FUNDING SYNERGIES

Integrating a more strategic and coordinated approach in the access to ESIF and other funds can improve synergies and hence the implementation of S3 and its impact. This could be particularly relevant to enhance the outward looking perspective of S3 and for regions with weaker research and innovation systems that have difficulties in accessing EU collaboration networks and participating in H2020 /Horizon Europe[41].

Reinforcing the capacity of HEIs to strengthen their international networks, training researchers and managers in EU programmes and providing the managerial support to access EU consortia can be particularly relevant to introduce synergies within S3 governance and ensure a leverage effect in the R&I system.

BOX 5.3:

INTEGRATING SYNERGIES IN S3 GOVERNANCE

In the Basque Country, an Internationalisation Working Group has been created to share relevant information about calls and funding programmes and to facilitate the co-generation of potential project ideas utilising different stakeholder capacities. HEIs are an important part of these groups and bring their international networks and knowledge to S3 implementation.

41   Andrea Conte & Nida Kamil Ozbolat, (2016) "Synergies for Innovation: Lessons Learnt from the S2E National Events," JRC Working Papers JRC104861, Joint Research Centre

CONCLUSION

There is no 'one-size-fits-all' in relation to funding instruments for S3. The efficiency of a funding scheme depends on its capacity to match policy objectives with beneficiaries' needs and should incorporate:

— A framework analysis of regional HEI drivers and the match with S3 objectives and priorities.
— Ensuring complementarity with the existing funding landscape by limiting duplication.
— A balance between narrow and broad topic definition that has been tested with a good identification of relevant academic competencies.

CHAPTER 6:
MONITORING AND EVALUATION

Monitoring is critical for S3 to measure progress and delivery of its objectives through different policy instruments.[42] An S3 monitoring system should be articulated (at least) through output indicators (direct products of policy interventions) and result indicators (socio-economic changes in target groups), reflecting the specific objectives of the strategy[43]. Monitoring systems can comprise a range of tools and methodologies, including surveys, data visualisation, qualitative analysis, and insights from stakeholders.

S3 monitoring serves different purposes, such as the need for public accountability or to communicate to stakeholders on the strategy's development. However, as S3 is a transformative strategy, one in which knowledge creation, dissemination and diffusion are at the core of territorial development, monitoring can also capture positive spill-overs derived from S3 implementation, i.e. monitoring can become a learning tool. The purpose of monitoring must be both to measure the effects of public policies but also to reflect on them to improve their efficiency and effectiveness.

In addition to being a subject of monitoring, in terms, for example, of the nature and impacts of their contribution to S3 formulation and implementation, HEIs can provide analytical and research skills that are essential to monitoring as a learning tool. Their engagement in S3 monitoring[44] can also be a form of knowledge transfer to policy support. HEIs are multidisciplinary and multifunctional actors; they need to have a clear understanding of where they fit within the strategy and their capacities to contribute to S3 across its different priority areas. The following sections describe main areas for HEI contribution to S3 monitoring.

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42 European Commission, 2011; See: https://iversity.org/en/courses/monitoring-smart-Specialisation-strategies

43 Gianelle, C., Kyriakou, D., Cohen, C. and Przeor, M. (Ed.) (2016), "Implementation of Smart Specialisation Strategies: a Handbook", European Commission, EUR 28053 EN; and Gianelle, C., Kleibrink, A. (2015) Monitoring mechanisms for smart specialisation strategies. S3 Policy Briefs. Available at: https://s3platform.jrc.ec.europa.eu/en/w/monitoring-mechanisms-for-smart-specialisation-strategies?p_l_back_url=%2Fsearch%3Fq%3Dmonitoring%2Bmechanisms

44 Through consultancy agreements, training, research or traditional education, as well as other activities

MONITORING SYSTEMS: DESIGN, DATA COLLECTION AND ANALYSIS

Smart specialisation requires monitoring systems capable of providing information on how S3 is being implemented and the effects it is generating and supporting the public sector and stakeholders in their learning processes. These activities require research and analytical skills that are at the core of HEIs and can equally serve research purposes and academic outputs.

HEI experts can contribute to designing and populating S3 monitoring systems in a number of ways:

— through developing general and priority-specific methodologies and measurement approaches that support the process of learning by monitoring.
— through constructing new or improved databases, and data collection processes to collect previous inaccessible or unavailable data.
— in the design of theoretical and empirical tools to analyse data and extract conclusions on the impact of public policies, e.g. 'cost-benefit analysis', additionality and econometric models.
— the use of open data and big data tools to analyse and extract conclusions from the data and HEIs can collaborate in this process.

These are covered in the case studies included in the 6.1 below.

BOX 6.1:

HEIS SUPPORTING S3 MONITORING

THE RIS3CAT (CATALAN S3) MONITORING SYSTEM: INTRODUCING 'LEARNING'

The Catalan model to monitor the RIS3CAT, previously mostly accountability-based, was modified to ensure a predominant role for 'learning', whereby the monitoring system identifies how stakeholders that participate in S3-related projects 'learn' and improve their capacities and outcomes thanks to the dynamics and positive externalities that are generated. The monitoring system includes a questionnaire addressed to beneficiaries that examines the learning opportunities the project has provided and stakeholders' new skills, partnerships and interests.

THE NORTHERN NETHERLANDS INNOVATION MONITOR

The Northern Netherlands Innovation Monitor (NNIM)[45] runs an annual survey on SMEs in the region with results analysed by a PhD researcher. Participating firms receive an individual benchmark report and are invited to engage in the Innovation Monitor expert panel and policy review group.

THE CONNECTIVITY MODEL IN OSTROBOTHNIA[46]

The University of Vaasa has developed a research tool called **the Connectivity Model**, to measure the connections among local actors, as part of S3 monitoring. The tool comprises a survey, focus groups and the development of gap indexes to allow an in-depth understanding of the relationships among actors in the innovation system. It enables a comparison of the expectations and the actual experiences of a set of relationships, insights into the bottlenecks and opportunities within the local triple-helix system and generates information relevant for S3 planning and monitoring. As the data collection and analysis are repeated it provides a longitudinal understanding of connectivity among local actors.

ICT TOOL DESIGN UNDER SMART_WATCH PROJECT[47]

The SMART_watch project is co-financed by the Interreg Central Europe programme, and it aims to improve the implementation of S3-linked policies and strategies in different regions from seven EU Member States (Austria, Czechia, Hungary, Poland, Slovenia, Germany and Italy). Among the activities developed under this project, the FH Joannaeum – University for Applied Sciences in Austria has designed a tool that will allow S3 monitoring in the participating regions. Data will be collected to enable the benchmarking of S3 initiatives and a map of smart specialisation markets.

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45 Set up in 2015 by the Northern Netherlands Alliance (responsible for the S3 in Northern-Netherlands) in collaboration with the University of Groningen to enhance data provided by the Statistics Bureau. See: https://www.snn.nl/en/erdf-and-projects

46 https://www.obotnia.fi/en/regional-development-2/smart-specialisation/preliminary-results

47 https://www.interreg-central.eu/Content.Node/SMART-watch.html

HEI AS STAKEHOLDERS IN A PARTICIPATORY MONITORING PROCESS

For monitoring to enable learning, it must also be a participatory process, one in which stakeholders are able to understand how the strategy is evolving and contribute to making it a success. HEIs engagement in monitoring can involve scientists involved in S3 priority areas or HEI managers with an overview of the institution as a whole, reflecting their dual role as experts to support the policy and monitoring process and as stakeholders, i.e. potential beneficiaries of S3-related funding.

BOX 6.2:

HEI STAKEHOLDERS IN S3 MONITORING

ORKESTRA AND THE EUSKADI GOVERNMENT – AN ONGOING COLLABORATION IN THE BASQUE COUNTRY[48]

Orkestra participates in the Interdepartmental Government Group for S3 in the Basque Country as well as undertaking analytical work that feeds directly into the policy decision-making process. This involves undertaking in-depth interviews with stakeholders and reviewing working documents. Orkestra complements its in-depth understanding of the local context with knowledge of the international context and policy debate.

EXTREMADURA: MONITORING WORKING GROUPS[49]

Extremadura has organised a set of priority-specific working groups for monitoring purposes, each one with HEI representation. The working groups comprise between 12 and 25 participants who meet twice a year. Stakeholders are asked to comment on the monitoring results and then come up with suggestions on policy instruments.

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48   http://www.orkestra.deusto.es/es/investigacion/publicaciones/cuadernos-orkestra/989-implementing-ris3-case-basque-country

49   http://www.ris3extremadura.es/

HUMAN CAPITAL DEVELOPMENT AND MONITORING: FORMAL EDUCATION AND PROFESSIONAL TRAINING

The creation of human capital in local HEIs and the capacities and skills of HEIs students represent a significant asset for S3 implementation: policy-makers need to understand whether the specific skills for S3 are being developed and identify ways to make the most of them. Higher education must contribute to driving regional development, competitiveness and growth through targeting specific needs in skills and human capital provision and development in smart specialisation areas, as an integral part of S3 implementation.

Labour market skills intelligence and co-operation between employers and education and training will ensure the creation of high-quality education and training that is relevant to the needs of the territory, the development and update of labour market relevant skills for the work-force and innovative approaches to the twin transitions through closer cooperation between education, business and wider society.

The monitoring process should therefore include data on teaching pro-grammes relevant to S3 (e.g. student participation, employability, mo-bility) and HEI undergraduate and postgraduate students working in disciplines relevant to S3. These research projects and academics could be used to support S3 design, data collection and analysis and moni-toring.[50]

HEIs can also work with public administrations to build capacities for S3 monitoring through the provision of professional courses on S3 mon-itoring including the intervention logic, the choice of indicators, data analysis and visualisation.[51]

HEI AS CHAMPIONS OF MONITORING

HEIs, can have an important championing role for monitoring, stimu-lating the debate around monitoring as a tool for public accountability, evidence-based decision-making and shared learning and engaging

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50   "Industrial PhD programmes" may be particularly relevant for this type of activity.

51   Undergraduate and post-graduate programmes, especially in public policy, political sciences and economics, often include training on policy monitoring and evaluation but lack public administration consultation to co-design the curricula.

with policy-makers and stakeholders. This could include scientific or informative seminars in cooperation with public authorities, as well as publications or other public outreach activities.

HEI AND S3 MONITORING: OBSTACLES AND RECOMMENDATIONS

Smart specialisation demands a monitoring system that not only keeps track of progress in implementation but one that enhances learning for all stakeholders. HEIs, with their analytical and reflective abilities, as well as their interdisciplinarity represent an asset in implementing such a monitoring system. However, whilst HEIs have a stake in S3, the incentives for HEIs to engage in S3 monitoring are limited. Additionally, HEIs and regions are very heterogeneous, there is no "one-size-fits-all" model, and hence not all the institutions will possess the relevant knowledge, profile, competences or capacity, in terms of analytical, research and teaching skills, as well as ability to connect to territorial actors.

CHAPTER 7:
WAY FORWARD

The process of designing and implementing S3 has produced a positive change in the governance of innovation policy in many territories. At the centre of the process is the ability to organise and engage in an effective EDP. This requires knowledge exchange in a continuous learning process in which key organisations: public authorities, businesses and citizens in so-called 'quadruple helix' partnerships identify, define and review policy objectives as an iterative process based on evidence. HEI engagement and participation varies; institutions have diverse geographical locations, capacities, profiles, challenges and incentives and hence engagement in the design and implementation of S3 and broader regional economic development and industrial transition.

Higher education has a key role in connecting to and shaping future territories and communities through contributing to identifying and developing the most promising areas of innovation and regional strength and strengthening links with business, industry and government. Nevertheless, inter-regional cooperation is essential for smart specialisation – innovation often depends on exchanges and spill-overs from cooperation and research and innovation networks are increasingly global.[52] Regional innovation systems cannot be considered in isolation, and HEI's should ensure an outward-looking perspective through reinforcing HEIs' international networks, training researchers and managers in EU programmes to enable access to EU consortia. HEIs must work collaboratively transnationally to develop common research themes, create critical mass and share capacity to respond to Europe's challenges and lead in the transition to a climate-neutral economy and new digital age.

HEIs have a lot to contribute equally in relation to skills for transformational innovation. S3 is a transformative strategy, one which places knowledge creation and dissemination at the core of territorial development. S3 monitoring provides a critical learning tool to not only measure the effects of public policies but also to reflect on them to improve their efficiency and effectiveness. HEIs contribution to S3, their regions' economic development and green and digital transitions requires an investment in human capital and a targeted provision of ed-

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52   Woolford, J., Amanatidou, E., Gerussi, E. and Boden, J.M., (2020) Interregional Cooperation and Smart Specialisation: a Lagging Regions Perspective.

ucation and training on those specialisations and skills that are most needed.[53] By integrating research, teaching and external engagement, the knowledge and intellectual and human capital assets created by universities can have much greater impact for the region and develop new solutions to economic, social and environmental problems.

Education and skills and research and innovation are key to European competitiveness, economic, social and territorial cohesion and regional growth, and higher education occupies a privileged place at the interface of research, education and innovation, able to provide the workforce skills needed for transition and recovery and produce cutting edge research and knowledge, contributing to regional development, innovation, resilience and preparedness. The European Commission looks to build on these initiatives and create a transformation agenda for higher education by the end of 2021.

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53   Pontikakis, D. et al (2020) Projecting Opportunities for INdustrial Transitions (POINT): Concepts, rationales and methodological guidelines for territorial reviews of industrial transition.

ANNEX I:

MAPPING HEI FOR THE EDP

HEIs activities	Potential Data sources
Education	— Student records — Student and graduate surveys (e.g. social profile, employment outcomes, etc.) — Profile of educational/training/placement supply — EU projects in programmes supporting education (ie. Erasmus+, MSCA) — Pertinent prizes and excellence in education labels — Strategic plans emphasising the local impact of education
Fundamental research	— Bibliometrics — EU, national and regional projects in programmes supporting basic research — Pertinent prizes and excellence in research labels — Strategic plans emphasising fundamental research and potentially bridging with applied research
Applied research and TT	— EU projects supporting industrial leadership and societal challenges — Contract research — Patents — Clinical trials — No. of MA and PhD in applied fields — No. of Startups/Spin-offs — Hosted TTOs or related structures — Participation in TT-related activities, collaborative platforms, clusters, etc. — Pertinent prizes and excellence in TT labels — Strategic plans emphasising 3rd mission
Social Innovation and civic engagement	— Consultancy activity with public administrations and non-profits — Hosting social innovation organisations — Participation in social innovation activities and projects — Pertinent prizes and labels — Strategic plans emphasising civic engagement
Internationalisation	— International co-publications — EU projects with international partners — Participation in international associations and platforms — Strategic plans emphasising international engagement

GLOSSARY OF MAIN TERMS AND ABBREVIATIONS

CBE - Competency-based Education

ECTS - European Credit Transfer System

EDP - Entrepreneurial Discovery Process

ERA - European Research Area

ESIF – European Structural and Investment Funds

HE - Higher Education

HEI – Higher Education Institutions

RIIA – Regional Innovation Impact Assessment

S3 – Smart Specialisation Strategy

Tertiary Education - Vocational Education and Training (VET) and Higher Education (HE)

UAS - Universities of Applied Sciences[54]

VET - Vocational Education and Training

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54   UaS may be called: Fachhochschule (Germany), Hochschule (Netherlands), Polytechnics (Portugal) or
      Institutes of Technology (Ireland)]

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