Higher Education for Smart Specialisation

A Handbook

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Foreword

This Handbook is the result of more than two 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), as part of the project 'Higher Education for Smart Specialisation' (HESS). It has been a learning journey for all those involved, including regions, HEIs, the European Commission and external experts (such as the contributors to the Handbook). However, we are not yet at the end of this journey. While there is agreement that HEIs can have a pivotal role in regional development and innovation, the focus is often on their role in knowledge production. In the context of smart specialisation we also need to know how HEIs can better promote knowledge dissemination and application through cooperating with regional partners, or with their most important 'products'; students who can provide valuable human capital.

While this Handbook has been informed largely by the HESS case studies, it is labelled version 1.0 because feedback from both national and regional authorities as well as HEIs is the best way to improve the guidance that we can provide. Furthermore, in relation to European policies, the next 12 months are important in framing funding programmes post 2020, and the outcome of negotiations will provide more clarity on how the EU can better support regions in their quest to become more smartly specialised. Therefore an updated version of the handbook will be published based on further knowledge co-created with regions and HEIs. In the meantime, 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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Chapter 1: Engaging with Higher Education Institutions

Contributors: John Edwards, John Goddard

Higher Education Institutions (HEIs)[1] have the potential to play a key role in regional transformation through contributing to Smart Specialisation Strategies (S3). This Handbook is targeted principally at national and regional authorities responsible for smart specialisation, and is intended to illustrate how they can form strategic, mutually beneficial partnerships with HEIs. Readers will learn about the different capacities of HEIs and the specific contributions they can make to the design and implementation of S3. At the same time, the Handbook shows how partnerships can only be built by understanding the challenges and incentives that HEIs face in engaging in such policy process. The handbook also aims at bridging the distance between policy makers and HEIs in relation to regional development, opening a space for dialogue and common understanding. Examples from across Europe and beyond are included for inspiration, but not to copy and paste, since like smart specialisation overall, a place-based approach is needed to tailor the contribution of HEIs to specific regional settings and strategic objectives.

Smart Specialisation is a central part of the EU Cohesion Policy, having been introduced in the current programming period (20014-20) to prioritise funding in those areas where countries and regions have the most potential for knowledge-based development. EU Member States were asked to select national or regional priorities based on intelligence generated by the local innovation system – the so called 'Entrepreneurial Discovery Process' (EDP). Guidance provided by the European Commission stressed that this process should be continuous and priorities not be 'set in stone' – for which well-designed governance and monitoring frameworks are essential. In addition to the European Structural and Investment Funds (ESIF), the Commission has also encouraged the synergetic use of centrally managed EU funding research and education programmes (e.g. Horizon 2020, Creative Europe and Erasmus+).

This Handbook includes chapters on these four elements of smart specialisation and shows how HEIs are extremely relevant at each stage: the EDP (Chapter Four), Governance (Chapter Five), monitoring (Chapter Six) and strategic use of public funding (Chapter Seven). Before that the Handbook helps national and regional authorities to understand how HEIs tick – both as institutions (Chapter Two) and the people who work there (Chapter Three).

The purpose and impact of higher education

It is important for regional authorities to understand that the primary purpose of HEIs is education and research, although the balance between the two areas can differ between institutions. It is increasingly common for governments funding higher education to require HEIs to have a 'third mission' serving the public good, broadly defined to include engaging with business and the community but seldom with specific reference to city and

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[1] 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 sometime used interchangeably.

regional development. However, by definition and in practice, it is considered less important than the first and second missions.

Conventionally university research-performance and that of individual academics has been assessed by papers published in peer-reviewed journals (often linked to a single discipline) and by frequency of citation as a measure of impact on the global scientific field. These performance indicators, aggregated across different disciplines, are then used by various bodies and the media to inform global rankings of universities. In the case of publicly funded education, governments have monitored the effectiveness and efficacy of their HE system through indicators based on completion of degree programmes, student satisfaction surveys and post graduate employment outcomes

Regional authorities naturally like to see HEIs in their territories ranked highly as part of national and global positioning. This can help to attract international students and leading scholars, raise the profile of the region and provide direct local impacts through the inflow of students and the scale of the institution as a local employer. However, these are in fact relatively minor benefits compared to the transformative role HEIs could play through their engagement in a regional innovation eco-system.

However, when it comes to the third mission, there are no ready metrics; outcomes can turn up in a variety of spheres beyond HE like improved business performance through research links and employment of skilled graduates and these *may* have specific regional impact. Perhaps the most visible local impact is in the form of spin out businesses established by researchers and graduates - this is why regional authorities often support business incubators. In short, it is partly for reasons of accountability that third mission activity has remained an unfunded mandate in most counties.

This model of public funding and accountability has implications for how long established HEIs are led and managed. These institutions are traditionally organised around academic disciplines with teaching and research being treated as separate functions. Academic staff are incentivised by research outputs and management is light touch making institutional steering difficult. Insofar as a third mission is recognised the focus is on income generation rather than the public good - there is in effect a hard boundary between the HEI and the outside world. The consequence is that many traditional universities are *in* the region but not part *of* the region. Other institutions such as universities of applied science may differ by placing greater emphasis on teaching and community service and with stronger management. So regional authorities wishing to work with HEIs in their area need to understand the institution's origins, development and their management structures – talking to the rector may not always be the right strategy.

The evolving purposes of higher education institutions

The above picture of publically funded higher education is changing rapidly and the drivers are coming from both inside and outside of the sector. Smart specialisation can be one such driver. In essence governments and citizens are asking not only what HEIs are *good at* (e.g. the research excellence metric) but what are they good for (the contribution to the challenges facing civil society locally as well as globally). This question has a territorial dimension not least because many political processes operate this way – mayors and members of parliament ask: we have an HEI in our city/region but how can it contribute more to society and economy? These issues are particularly important for less developed regions – how can the HEIs contribute to raising regional competiveness

and developing a more sustainable and inclusive society? Increasingly governments are asking HEIs to contribute to place based development overall – economic, social and environmental through teaching as well as research.

It is important for regional authorities discussing smart specialisation with their local HEIs to set this discussion in the context of the changing thinking at a European level about the links between research and innovation, which may influence how HEIs act locally. In essence it is being increasingly recognised that the 'science push' or linear model of innovation based on research commercialisation and which has underpinned third mission activity and the role of universities in regional development is outmoded. For example a recent review of innovation policy has noted:

"Innovation happens in complex ecosystems. Too often we imagine innovation in a linear way, as a pipeline with inputs and outputs. … We need more open collaboration both globally and locally between citizens, government and inventors… Focus on people, places and processes…our innovation economy is not a roman aqueduct but a muddy pond. It requires all actors – corporate, academic, civil and political"[2]

This resonates with Responsible Research and Innovation as a cross cutting theme in the societal challenges addressed by Horizon 2020 and posed by the UN Sustainable Development Goals[3]. The key point here is that societal challenges such as those arising from an ageing population and environmental sustainability are local as well as global. Addressing them requires building capacity for collaboration by diverse actors coming together in 'quadruple helix' partnerships embracing HEIs, business, public authorities and organisations representing civil society.

The Future of Smart Specialisation and the role of human capital

Surveys by the European Commission as well as external experts have shown that while it is too early to assess the results of the EU's smart specialisation approach overall, the process of designing and implementing S3 has produced a positive change in the governance of innovation policy in many countries and regions[4]. However, one of the missing links has been identified as human capital in many senses, including for example the capabilities of regions to manage a strategy and coordinate an entrepreneurial process of discovery. HEIs clearly have a lot to contribute, particularly in the development of the quadruple helix partnerships, as well as skills for innovation among graduates and the population at large through adult learning. The recognition of human capital as a key driver of smart specialisation has led to the European Commission proposing a new objective for the European Regional Development Fund to invest in 'Skills for Smart Specialisation, Industrial Transition and Entrepreneurship'[5]. This investment in human capital will be complemented by the proposed European Social Fund Plus[6], but be targeted specifically on implementation of S3.

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2 Madelin, R. (2016). Opportunity Now: Europe's Mission to Innovate, Luxembourg: Publications Office of the European Union

3 https://www.un.org/sustainabledevelopment/sustainable-development-goals/

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

5 European Commission (2018) Proposal for a Regulation of the European Parliament and of the Council on the European Regional Development Fund and on the Cohesion Fund, COM(2018) 372 final

6 European Commission (2018) Proposal for a Regulation of the European Parliament and of the Council on the European Social Fund Plus, COM(2018) 382 final

Smart specialisation is an evolving concept and policy approach that has matured substantially since it was introduced in 2012. While HEIs have always been instinctively considered important actors in S3[7], the aim of the HESS project is to analyse in more detail how this can be the case, and through this Handbook and other activities 'on the ground', give guidance to S3 managers on how it can be done in practice. At the same time, we hope the Handbook will be useful also to HEIs managers and researchers, building a common understanding of what S3 is. We hope that the handbook goes some way to advancing this objective.

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7 For example, see Kempton et al (2013)

Chapter 2: Understanding Higher Education

Contributors: Ellen Hazelkorn, John Edwards

Summary

This chapter helps readers understand Higher Education (HE) and the drivers and trends that are shaping the behaviour of universities and other Higher Education Institutions (HEIs). By understanding HE, national and regional authorities responsible for smart specialisation will be better placed to engage with HEIs and form more effective partnerships. The chapter looks at the changing nature of HE, the world of work, societal demands and the implications for HEIs. It also explains how HE systems are governed and how reforms can make HEIs more responsive to regional objectives.

Introduction

Higher education is part of a broader landscape of tertiary or post-compulsory system of education. Tertiary education is wide-ranging but normally includes Vocational Education and Training (VET), and Higher Education (HE), as well as adult and community education, foundation and second-chance education, skills development and continuing education. There is no common EU definition.

In Europe, HE comprises academic or theoretically-based research universities, and professional or technologically-oriented Universities of applied Sciences (UaS). The latter may be called: Fachhochschule (Germany), Hochschule (Netherlands), Polytechnics (Portugal) or Institutes of Technology (Ireland), depending upon the country. Differences between institutions have become blurred but they all emphasize students' skills and employability. As the *New Skills Agenda for Europe* underlines, one of the most important contributions HEIs make to society are its graduates, often referred to as human capital[1].

This chapter provides an overview of higher education in three main sections. Firstly, it describes the HE landscape and recent developments; secondly, it looks at trends in the world of work, and the implications for HE; and thirdly, it discusses governance arrangements in terms of the educational landscape and societal requirements.

The Higher Education Landscape

Over recent decades there has been a tremendous transformation in HE, in response to demographic and labour market changes. According to the European Tertiary Education Register (ETER)[2], there are approximately 2,200 HEIs in the European Research Area (ERA), providing academic, professional and vocational education and training. Almost half were founded after 1970, most of which are UaS – often as a result of being upgraded from vocational or technical schools – rather than research universities. However, the core of Europe's research activity is conducted in the 365 universities established before the 20th century.

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1 European Commission (2016)
2 Data on new HEI formation available on the ETER website: https://www.eter-project.com/

HEIs offer qualifications from short-cycle Level 5 to Level 8 doctorate, as per the European Qualifications Framework (EQF) (See Table 1).

Table 1. EQF Levels and Learning Outcomes[3]

EQF Levels	Bologna Framework	Description
5	Short Cycle within First Cycle	Programmes designed to provide professional knowledge, skills and competencies; typically, practically based, occupationally-specific to prepare students to enter the labour market.
6	First Cycle	Bachelors' or equivalent: designed to provide intermediate academic and/or professional knowledge, skills and competencies, leading to a first degree.
7	Second Cycle	Masters or equivalent: designed to provide advanced academic and/or professional knowledge, skills and competencies, leading to second degree or equivalence; typically, theoretically-based but may include practical components and informed by state of the art research and/or best professional practice.
8	Third Cycle	Doctorate or equivalent: design to provide advanced theoretically-based qualification informed by state of the art research.

Across Europe, the number of students has risen significantly; the process of expanding participation is called 'massification'. The proportion of people aged 30 to 34 with a tertiary qualification has risen steadily, from 22.4% in 2000 (EU 27) to 39.1% in 2016 (EU28), just short of the *Europe 2020* target of 40%[4]. From 11m tertiary education students in 1992, there were 19.5m in 2015, of which 7.2% were in short-cycle tertiary, 61.4% undertaking a bachelor's degree, 27.8% a master's degree and 3.7% a doctorate. More students were studying for a bachelor's degree than for any other level of tertiary education in all EU Member States in 2015; in only a few countries was this fewer than 50% of students[5].

Europe has a strong history of public higher education; however, since 2000, most newly established HEIs have been private and they now account for 27% of all HEIs in Europe[6]. This is due to a combination of factors, including growing demand, flexibility in access and delivery methods, and restrictions on public budgets. Sometimes called "alternative providers" or "the independent sector," definitions vary depending on distinctions between non-profit and for-profit, and the extent to which institutions are in receipt of recurrent public funding for teaching and research. Due to national differences in how education is organised, in some European countries private HEIs represent just 5% of the

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3   More detailed description can be found on the European Commission website: https://ec.europa.eu/ploteus/en/content/descriptors-page
4 European Commission (2017a)
5 Eurostat (2017)
6 Data on new HEI formation available on the ETER website: https://www.eter-project.com/. The overall number of students in private HEIs is however likely to be much lower than in publicly owned HEIs.

total while in others it is over 50%[7]. Private HEIs are usually smaller, more specialised, and more regionally concentrated, and more likely to focus on teaching than research with some notable exceptions[8]. Private HE tends to operate outside national governance and monitoring arrangements because they are either insignificant in terms of scale or considered independent businesses (although still have to meet accreditation standards).

Student mobility and internationalisation is also changing the face of Europe's education system. The EU Erasmus programme which began in 1987-1988 has supported more than three million European students to study, train and gain experience in another Member State[9]. Internationally, the number of students studying in other countries has also risen from about 0.8m in the 1970s to over 4.6m today; approximately 25% of international students are at doctoral level in STEM (science, technology, engineering and mathematics) subjects[10]. Europe is the most popular destination for non-EU students; it hosts 48% of all tertiary students studying outside their country of origin, with the UK, France and Germany attracting the highest numbers[11].

Attention has primarily been focused on widening participation to college-ready 18-22-year-olds. In the future, demand will come increasingly from under-served sections of society, e.g. low-income, socio-economically disadvantaged, and first-in-family students, as well as from migrants and refugees, mature students and life-long learners, and increasing internationalisation. Migration is one way to offset population decline and alleviate labour shortages, but so are mature learners and older people. In the US, the "post-traditional" student, those over 22 years, has become the dominant component of the tertiary population[12]; in Europe by contrast, adult participation in formal learning stood at only 10.8% in 2016[13].

While tertiary education is strongly nationally and sometime regionally-rooted, HEIs are increasingly trans-national and international in their orientation forming partnerships with universities in other countries for educational and research purposes. Multi-culturalism and cultural diversity is an increasing feature as universities and their neighbouring towns and regions attract students, academics and professionals from around Europe and the world[14]. A growing number of HEIs are committed to integrating refugees and migrants into their campuses and the labour market, which is encouraged by the European Commission[15].

As higher education systems have expanded, they have become more diversified but also more hierarchically stratified. There is a reputational intensity attached to attending a highly-ranked or "world-class" research university or having one located in your town or region. But great care should be taken in reading global rankings as an indication of quality or guide to regional significance. Global rankings do not measure the quality of education or the contribution that universities make to their communities or to the economy, with the exception of U-Multirank, which has been developed with support

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7 Levy, D. C. (2012)
8 For example: Central European University, Budapest; Bocconi University, Milan; Royal College of Surgeons, Dublin
9 European Union (2017)
10 OECD (2017)
11 OECD (2014a)
12 U.S. Department of Education (2016)
13 European Commission (2017b)
14 For a European overview, see the European University Association's 'Refugees Welcome Map': http://www.eua.be/activities-services/eua-campaigns/refugees-welcome-map
15 For more information on EU funding to integrate migrants in HEIs see: https://ec.europa.eu/education/policy/migration/higher-education-refugees_en

from the European Commission[16]. Moreover, over-emphasis on "world-class" can undermine other policy requirements and social equity, and the spill-over benefits can be limited. At the same time, using rankings to influence a university's strategy and priorities can be financially costly and damaging to its regional mission. This is because rankings over-emphasize research and international reputation and thus undermine regional commitment, including research in the national language or which can have particular value to the region.

The spatial distribution of HEIs

Higher education can play a key role in social and economic development nationally and regionally. Thus, where institutions are geographically located can be a contributory factor in aiding student access and successful participation, as well as being a magnet for mobile investment, business and talent, and fostering collaboration between universities, enterprise and civil society. When HEIs adopt a place-based strategy they can leverage the attributes of their region's history, environment, economy, culture, and literature to inform their education and research priorities.

Figure 1 shows the distribution of European HEIs. The greatest numbers of institutions are located in large metropolitan areas and capital cities. PhD-awarding HEIs are more concentrated in these cities while UaS are more likely to be located in smaller towns. There are a significant number of regions across Europe without any HEI or with just one or two. The spatial distribution of different types of HEIs has implications for smart specialisation, and especially for peripheral regions where there is a need for both human capital and RDI. Because it is not financially, demographically or economically feasible to establish a university in every town/region, multi-site universities and collaboration between different types of institutions, including between VET/TVET and higher education, provide strong and successful alternative opportunities. One of the first countries to create multi-campus HEI networks was Finland, as described in Box 1.

Figure 1. Number of HEIs by region (EUROSTAT, NUTS regions level 3)
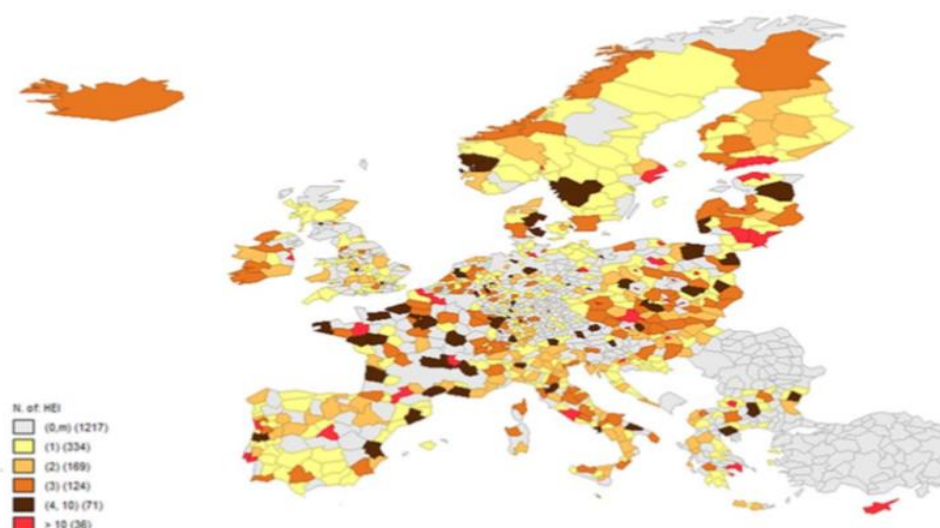
Source: ETER brief n. 4. Brussels: European Tertiary Education Register: https://eter-project.com/assets/pdf/ETER_regional_dimension.pdf

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16 See U-Multi rank website: https://www.umultirank.org/

Box 1: Multi Campus University Consortia in Finland

Since the 2000s Finland has embraced the concepts of collaboration, alliances and mergers among HEIs[17]. While high profile mergers such as the one creating Aalto University in 2010 have captured much attention, the emergence of university consortia with satellites in less developed regions is interesting for S3 policy mixes. The consortia provide adult education as well as research activities, enhancing the demand for scientific knowledge among the region's workforce. Furthermore, research is focused on the needs of SMEs and regional stakeholders play an influential role in the governance structures. In 2013, these university consortia had an annual turnover of 11 million euros, directly employed 130 people and had 2,400 students (of which 220 were enrolled on degrees, showing the flexible nature of the HE provision)[18].

For more information see: Piispa, P (2013)

21st Century Skills and the Changing Pedagogical Landscape

We are only at the beginning of the Fourth Industrial Revolution but already there is strong evidence of dramatic change over the next century. Developments in genetics, artificial intelligence, robotics, nanotechnology, 3D printing and biotechnology, etc. are laying the foundation for a revolution more comprehensive and all-encompassing than anything we have ever seen. According to CEDEFOP, the European Centre for the Development of Vocational Training, most new jobs will be in knowledge- and skill-intensive occupations, such as high level managerial and technical jobs. However, vocational skills will still account for almost 50% of the future labour force (see Figure 2).

These developments have implications for higher education. Changes in the kinds of jobs and the nature of work, and where and how people live, will require employers and people in general to be far more flexible and adaptable, and engage in continual upskilling. This means that as people live healthily for longer, they are likely to change careers, not just jobs, many times during their lifetimes. They will require greater preparation for a wider range of competences, deeper embedding of what are called "soft skills", as well as continuing access to a wider range of educational programmes.

Box 2: Dual Education and Training System in Germany

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 staff competences and reduce recruitment costs, while for employees it provides a more secure career path. Thanks 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 allows a more integrated response to new challenges and the digital revolution.

More info and inspiration see: Euler, D (2013)

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17 For more information about collaboration, alliances and mergers among HEIs see Williams, J (2017)
18 Zajda, J and Rust, V (2015),

Responding to anticipated and unanticipated change over the coming decades requires HEIs to become more flexible in how they develop and deliver education and training, and the design of campuses and buildings. Reforms are allowing students to combine theoretical and skills educational programmes in different ways and at different times. Internships and new apprenticeship systems, drawing on the German "Dual System" experience, bridge training from HEIs to firms (See Box 2). Before long, students will be able to tailor their entry, exit, assessment and qualifications to their personal needs, rather than being required to fit a standardized model. Credit-accumulation based systems – such as the European Credit Transfer System (ECTS)[19] – can enable students to study selected parts of a programme over time, often in different locations, as a way to gain qualifications or upgrade skills.

Figure 2. Changing Occupational Structure of Employment, EU27, % change
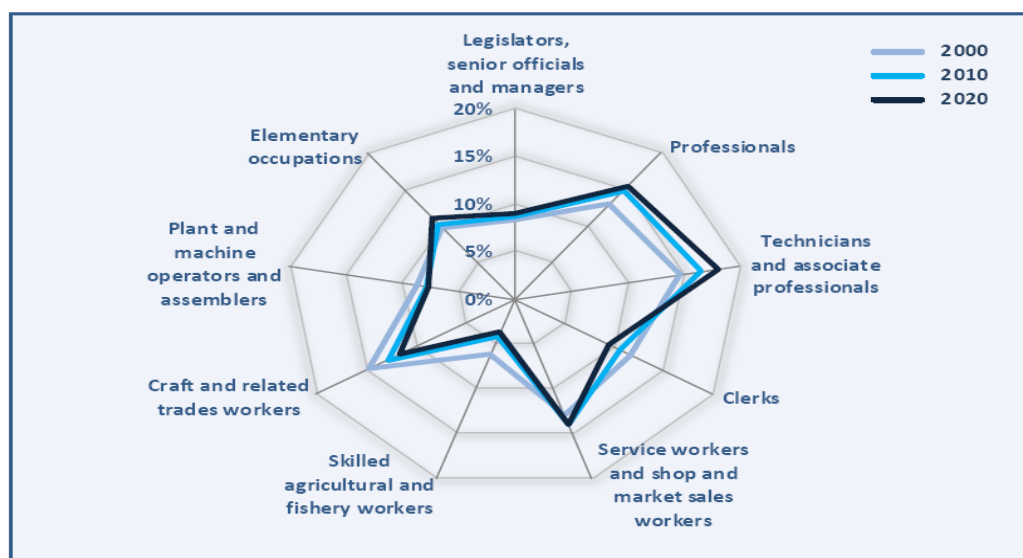
Source: Cedefop (based on IER estimates).

Source: Cedefop (2012) *Future skills supply and demand in Europe. Forecast 2012*. Luxembourg: Publications Office of the European Union. p27.

In addition to formal qualifications identified in Table 1, there is a less well understood world of non-formal and informal diplomas, certificates and professional examinations[20]. These education programmes provide one or two years of career preparation as well as alternative, stackable and micro-credentials which lead to immediate employment or provide the stepping stone to further advanced qualifications. Competency-based education (CBE) is enabling students to gain entry to university on the basis of demonstrable competencies learned at work or through other experiences. This more flexible approach to higher education is supporting adult, part-time and mobile learners[21].

Digitalisation is facilitating many of these changes. It is often associated with MOOCs (massive on-line learning courses), but technology is helping improve the overall learning experience. It is also changing the way courses are delivered to students who might otherwise find it difficult to attend class because of time, location, cost or personal circumstance. In these respects, digitalisation is potentially transformative, not just for

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19 See: https://ec.europa.eu/education/resources/european-credit-transfer-accumulation-system_en
20 See OECD (2014) for more information
21 European Commission (2014)

the individual learner but for higher education itself. People say we are in the "early stages of a learning revolution"[22].

These developments have huge significance and advantages for regions which are anxious to attract investment and retain talent by ensuring education opportunities for all residents throughout their life- and work-cycle.

Governance Arrangements and National Regulations

Around the world, national systems of education are diverse. Having a wide range of HEIs, each with different missions and priorities, can allow the overall system to meet students' needs, provide opportunities for social mobility, meet the needs of different labour markets, and contribute to regional strategies[23]. Multilevel governance arrangements – recognising differences in authority, roles and responsibilities across institutional, local, regional and national levels – are essential to achieve these objectives. The primary (lead) responsibility is usually given to the appropriate ministry – the precise configuration and title differs between countries – or to an intermediary body[24]. Traditionally there has been a strong centralisation or concentration of legislative competences at the national level with responsibility for policy, strategic functions and long-term objectives.

European systems often have separate governance arrangements for universities of applied sciences and research universities reflecting their different educational pathways and occupational destinations, and their roles and missions. There is usually much stronger cooperation between the UaS, regional governments, and employers. This is because many UaS originated as local colleges or institutes and their mission is linked to employability and collaboration with enterprise[25]. In contrast, research universities are more academically and theoretically focused, and are more likely to be involved in international partnerships with similar universities in other countries. Institutional autonomy, accompanied by academic peer review, has been a fundamental principle of European research universities, underpinning academic professional self-regulation. It can pertain to organisational, financial, staffing or academic autonomy, and varies across the EU[26].

However, since the 1990s, there has been a noticeable shift to market-led and competitive mechanisms, and away from self-regulation, as the preferred way to regulate HEIs. This move also corresponds with wider public and political concerns about the need for greater accountability and transparency, and increased involvement of students, employers and other civil society groups in priority-setting and how the university is governed[27]. These changes have introduced tension between demands for greater public accountability vs. university autonomy. Performance-based funding (PBF) and target setting is becoming an increasingly common policy instrument used by governments to increase performance, and improve quality and productivity in higher education[28]. Some governments have introduced performance-based agreements or compacts, such as Austria, Ireland, Netherlands, Norway, and Finland. Meeting national and/or regional

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22 High Level Group on the Modernisation of Higher Education (2013)
23 Birnbaum, R. (1983)
24 Hazelkorn (2016)
25 European Training Foundation (2013)
26 For an overview of autonomy in Europe see the University Autonomy Tool: http://www.university-autonomy.eu
27 Hazelkorn, E and Gibson, A (2017)
28 See de Boer et al (2015)

needs, professional development, and collaboration with industry often forms an important part of these arrangements, such as the Lead Institutions Initiative in Austria, as described in Box 3.

Box 3: The Lead Institutions Initiative in Austria

Austria is one of the countries to use performance-based funding agreements to increase the quality of its higher education system, which were introduced by reforms in 2002. As part of these agreements, the 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 Engagement/Innovation). Strategic targets are set to increase cooperation as the basis for allocation of block funding. Most relevant for this Handbook is that the Lead Institutions Initiative (which also includes competitive funding for HEIs) aims to increase the contribution of HEIs to regional innovation priorities as set out in their smart specialisation strategies.

For more information see: OECD (2016)

Finally, countries often have different regulatory arrangements for public and private institutions. In recent years, there have been growing concerns about variable standards of teaching and learning, inadequate quality assurance, poor student care, and the pursuit of profit rather than concerns about the student experience. Additional concerns have been raised because of the number of internationally mobile students and HEIs offering cross-border or trans-national education (e.g. education in another country). These issues matter because the overall quality of education reflects back onto the reputation of the home country, as well as on graduate career opportunities. At the same time, the private sector is becoming an important part of HE provision.

For all these reasons – notably, to strengthen accountability, to improve quality, and to increase higher education's contribution to place-based needs and innovation – new governance and regulatory arrangements are being introduced in many member states, affecting both public and private higher education. Understanding how higher education is governed will help regional authorities to think of ways to involve HEIs in S3.

Conclusion

This brief review of recent developments in HE shows how traditional assumptions about its role and purpose are being challenged. How well-prepared is it to meet societal and labour market demands, now and into the future? How closely should research as well as education and training be aligned with the needs of the region? What is required to ensure better co-ordination and transitions between education and the labour market? There are no easy answers to the questions and one of biggest obstacles is that responsibilities for higher education and regional development are separated between different ministries and levels of administration. However, smart specialisation offers a means to integrate these policy areas by channelling EU and other funds into projects that implement regional strategies. In the next chapters readers will learn about the specific ways HEIs can contribute to smart specialisation in their regions.

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Chapter Three: Making S3 compatible with an academic career

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Summary

The research profession is increasingly considered unattractive due to limited development opportunities and worsening employment conditions. Activities of territorial and economic engagement, such as those required by S3, whilst formally acknowledged as part of HEIs missions, are not significantly rewarded in the recruitment and promotion of academics. This is especially the case in traditional universities, which privilege indicators based on scientific and teaching productivity.

To sustainably engage HEIs in S3, public policies need to take into account the challenges and incentives of the research profession, at its different career stages.

Whilst no one-size fit all approach can be identified, it appears important to:

1.   Re-think performance-assessment frameworks

2.   Devise policy instruments that respond to individual, institutional and regional incentives, providing new avenues for career-development.

Introduction

The Renewed Agenda for Higher Education[1] 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 HEIs to prove their public value (as explained in the introduction to this handbook).

These developments are clearly important for smart specialisation. Yet, engaging HEIs in S3 also requires an understanding of how individual academic careers are compatible with the afore-mentioned activities. All the more as the engagement of HEIs in S3 processes has often taken place through the participation of senior managers, rather than individual academics whose field of work is relevant to S3, leaving the issue of career-compatibility unexplored[2].

This chapter addresses these aspects by taking into account the following issues:

1. Academic career structure varies significantly across member states and typology of HEI: In this chapter we concentrate on academics from traditional universities, while comparing the situation with newer universities of applied science.

2. In many countries, the current supply of PhD graduates (academics at their early stages of careers) far outstrips the demand for lecturers or professors.

3. In traditional, research intensive universities there are limited structural incentives to engage in activities beyond research and teaching.

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1 European Commission (2011).

2 For example, see the HESS case study on Navarra: Campillo et al (2017)

In this context, opportunities for territorial engagement of HEIs need to be framed through policy instruments that respond to career incentives and interests of individual academics, which is far from easy.

The next section of this chapter describes the general framework for academic career development in European HEIs. It points out the reduced opportunities for early-career scientists and their limited incentives to engage in activities other than teaching and research. The following section identifies two potential ways forward that can support the alignment of academic careers with S3: (a) re-thinking performance-assessment frameworks; and (b) devising policy instruments that respond to individual, institutional and regional incentives, providing new avenues for career-development.

Academic career in European Universities: different models, limited opportunities

The academic career in Europe is complex, fragmented and differs widely between countries and HEIs. Differences in career-steps between European countries make comparisons difficult. As shown in Figure 1, the career structure for academics is defined by national/regional governments, hence is highly regulated, or is developed in contexts where HEIs have a high-degree of autonomy to set up certain working conditions and career path[3].

Figure 1 The different types of governance for the researcher labour market

Source: Doussineau et al. 2013; p.39
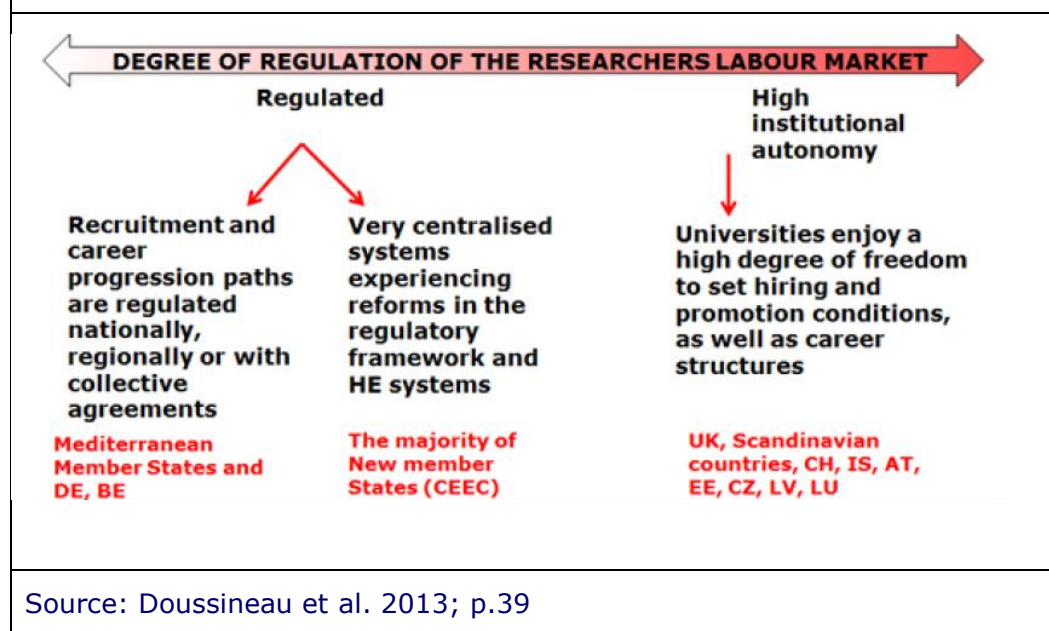
The European Research Area (ERA) Steering Group on Human Resources and Mobility (SGHRM) have developed a European framework for research careers in consultation with stakeholders[4], to improve their comparability. As mentioned by the SGHRM "*research careers frequently lack a clear and transparent prospective; early career researchers may not be aware of the range of opportunities across employment sectors. Employers are not always clear of the competences that researchers possess and the benefits they could bring to their organisation*" (EC, 2011; p. 1).

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3 Doussineau (2013).
4 European Commission (2011).

The SGHRM framework aims to support not only academics wanting to better understand their career perspectives and identify job opportunities, but also HEIs, other employers and authorities engaged in the policy and practice of the research labour market. The SGHRM describes four general profiles, typically associated with certain types of contracts and working conditions (see Figure 2):

a) *First Stage Researcher*: up to the point of PhD, usually consists of young researchers working on their doctoral dissertation (Doctoral Student grant or equivalent).

b) *Recognised Researcher*: PhD holders who are not yet fully independent to decide and lead research lines (Postdoctoral Researcher)

c) *Established Researcher*: researchers who have developed a level of independence (Senior Research Fellow)

d) *Leading Researcher*: researchers leading their research area or field (Professor, Research Professor).

As illustrated in Figure 2 below only about one third of early stage researchers will be able to reach the second stage of the career and a minority will find a place in later stages of the career[5], posing the question of researchers' career development outside academia.

Figure 2 Four-stage researcher career

Stage I   Stage II   Stage III   Stage IV

Stage I   Doctoral training stage
Stage II   Post-doctoral stage
Stage III Independent researcher stage
Stage IV   Established researchers (professors, research professors, directors, senior scientists, etc.)
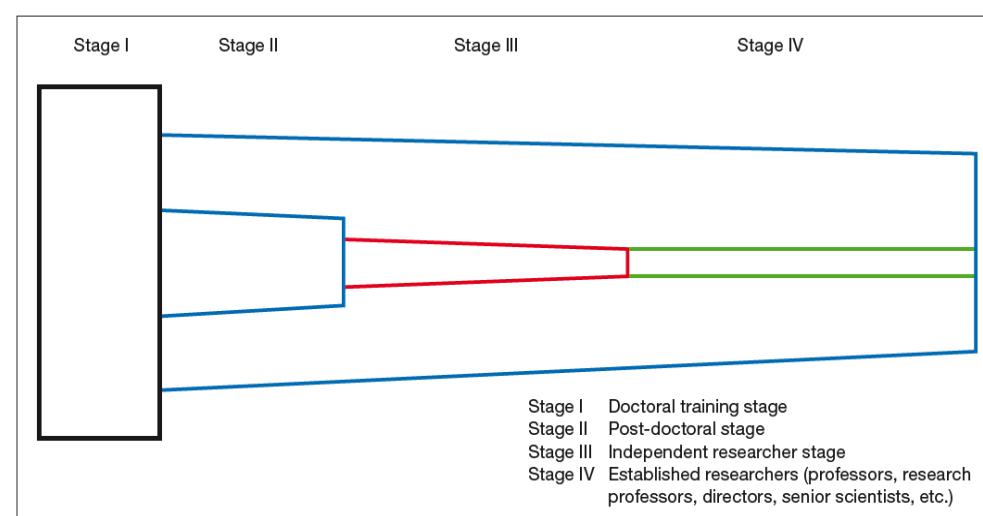
Source: European Science Foundation (2009; p.9)

The career paths from doctorate to professorship (or equivalent position) in academia also differ widely across Europe. The League of European Research Universities (LERU, 2014) has defined three basic models, which co-exist in Europe:

• The 'probation on-the-job model', prevalent in the UK, with permanent employment at an early career stage;

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5 Larson at al. (2014).

- The 'habilitation model' in central Europe, with permanent employment at a later career stage;
- The 'centralised state approbation model' in France, which combines tenure and habilitation.

Although each system has its pros and cons, when defining research-career paths it is important to acknowledge that researchers' interests are not always in line with universities´ priorities (See Table 1). The early-stage researcher's need for employment security and academic freedom must be kept in balance with the institution's interest in the flexibility needed for recruiting the best candidates at all career levels.[6]

Table 1 Researcher´s perspective vs institutions perspective on permanent positions

	Researcher´s perspective	**Institution´s perspective**
Permanent position early in a career	Academic freedom and employment security at an early stage: attractive and motivating, possible positive effect on quality. Less powerful external incentives for mobility and scientific development	Opportunity to develop research staff according to institution´s strategy and priorities. Binding staff members for a lifetime may have implications for efficiency and competitiveness in the long run
Permanent position late in a career	Many years of uncertainty in fixed-term positions and a highly competitive system: high personal cost. May lead to demotivation and contribute to `the leaky pipeline´(women dropping out of research careers because of poor work-life balance)	Opportunity to appoint the best candidates who have proven their competences over many years, but risk of losing highly qualified researchers to attractive offers outside academia.

Source: Science Europe (2016, p.8)

Regardless of the diversity among European universities, the limited demand for later stage researchers within academia makes the career, in general terms, less attractive[7]. Based on results from the MORE project (2017)[8], job insecurity appears to be the most important barrier to pursuing a research career. Other reasons that make the research career unattractive are: uncompetitive working conditions, relatively low wages, lack of career prospects, underfunding of universities and research institutions; the limited availability of research positions in academia, and insufficient cooperation between academia and the private sector. Last but not least, the financial crisis has led, in certain countries to the creation of a dual labour market, where employment conditions vary

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6 Science Europe (2016).
7 Science Europe (2016).
8 For more information about the MORE project see: https://www.more3.eu/project-description

(regardless of scientific productivity) between those with permanent positions, who have accessed the labour marked previous to the crisis, and those who embarked on an academic career afterwards[9].

It is interesting to point out that some European countries have a parallel university system containing different institutional settings (See Table 2). In particular, the existence of Universities of applied Sciences (UaS) is common in countries such as the Netherlands, Germany, Austria or Finland while traditional universities are predominant in Spain or Italy. UaS follow a more application-oriented approach in both their study programmes and in their recruitment. Engagement with regional development and local societal challenges is explicitly part of their mission and reflected in their study programme and hiring practices. As such, UaS provide food for thought on the potential career incentives and development paths for researchers.

Table 2 Traditional vs Applied Science Universities: career-development experiences

UaS academics find cooperation with local industry a natural part of their position, an intrinsic driver for career-development and receive recognition at institutional level for their promotion. Collaboration with industry is a necessary condition to teach at UaS and links with companies, NGOs and other regional stakeholders are facilitated by the university structure. Researchers at UaS state that they do not feel a high pressure to publish in international journals with high impact. Transfer of knowledge through joint reports with companies, consultancy services, organisation of joint workshops or events with regional stakeholders are career priorities.	**Academics at traditional universities** see engagement with industry or other actors in the region as a residual part of their tasks, since their focus is on teaching and research (approximately 60% - 40% respectively). Less than 10% of their time is devoted to 'third mission' activities, largely on a voluntary basis. Even though such activities are formally part of their performance assessment, the importance for career development is insignificant. Collaboration with industry is perceived as an additional burden to their already high workload, all the more as insufficient support is provided from the HEI, the activities are not adequately remunerated and their impact on career opportunities is limited in both the national and EU market.

Source: Fieldwork conducted for this chapter (2018)

S3 managers aiming to engage academics from traditional universities should be aware of the challenges that underpin their career development. Similarly, traditional universities willing to engage in regional development activities could consider designing different professional development paths. In particular it appears important to reflect on three points, which are discussed in the remaining of the chapter:

- The need to align individual, institutional and regional objectives to engage HEIs in S3 through an adequate performance assessment.

- The importance of providing adequate policy instruments, capable of responding to the different individual and institutional incentives.

- The opportunity of supporting different career-paths, in a context where there are limited chances to progress to a top career position.

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9 Doussineau et al. (2013).

Engaging researchers in S3: Performance appraisals, policy instruments and career-paths

Performance appraisals

Full-time academics, at all levels, working in HEIs normally have two main duties: teaching and research. In traditional universities external engagement activities are still marginal as reflected in performance appraisal frameworks. Indeed, teaching experience and publications continue to be the dominant criteria in tenure track systems and salary scales, while cooperation with industry, as well as engagement with territorial actors, is either poorly measured or not significantly considered for recruitment and promotion. In some European universities, it is even seen as unethical to collaborate with industry[10].

The lack of systematic assessment criteria to value work by academics in regional engagement is arguably one of the most relevant barriers to the involvement of HEIs in S3. This is especially the case for researchers at the earliest stages of their career, who are seeking a consolidated position in the university system.

Box 1: Vienna University of Economics and Business: new performance frameworks

Vienna University of Economics and Business is discussing a more comprehensive internal performance assessment system for full professors called *uLiKe* based on the performance assessment systems used by universities in Australia and New Zealand. Its goal is to develop a performance assessment method for staff appraisal that focuses on the quality, impact and consistency of their achievements while also taking into account specific personal contexts.

The system is intended to include diverse criteria that go beyond publication outputs and give more visibility to teaching, knowledge transfer activities and work in university development. In relation to the third mission, it takes into account 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 initiative received the *Diversitas award* from the Austrian Federal Ministry of Science, Research and Economy in December 2016.

More information: https://www.wu.ac.at/en/the-university/news-and-events/news/details-news/detail/diversity-management-award-for-wus-ulike-performance-assessment-system-1/

Furthermore, performance appraisals based on research output measures (such as publication counts and impact factors) while considered neutral, objective and easy to perform (as data is widely available in standardised format) have several pitfalls. In particular, they do not give adequate recognition to academic exploration in fields that tackle local issues but without a long record of publications. If academics are to contribute to regional development as part of their career, their performance assessment should value such activities. While this is generally not the case, it is important to highlight some relevant trends in that direction.

From the 2000s several OECD countries have introduced new measures to promote and reward university staff for developing industry linkages, such as R&D funds mobilized from private sources, earnings from consulting, income from patent licensing, and participation in spin-offs or start-ups. More recently, some universities are rebalancing

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10 Guimon (2013).

performance measures for internal promotion of researchers while others are in the process of defining different profiles for academics depending on their effectiveness and efficiency in teaching, research and third mission activities. Although these initiatives are not generalised, they provide valuable ideas to progress on the definition on new performance framework and criteria.

Taylor policy instruments to align institutional needs and individual career-paths

Engaging academics from traditional universities in S3 requires developing a policy mix that is compatible with their career incentives and pathways. Although they require more detail, policy instruments could include:

- *Instruments that support universities in engaging with the territory*, limiting the administrative burden of such activities for individual academics: Policy makers can find ways to support HEIs in their management and organisation of territorial engagement activities, such as through intermediary bodies between the HEI, the territory and academic staff. These should lift the administrative and organisational burden of third-mission activities from individual academics. This approach has proved useful in universities committed both to the territory and to scientific excellence, particularly in non-metropolitan areas, as shown by the example in Box 2.

Box 2: University of Girona: Sectorial campuses

The Sectorial Campuses of the University of Girona (UdG) are relational platforms with a market driven focus. Their main objective is to proactively build and support the relationship between companies and institutions in a given socio-economic sector and the University of Girona.

Different Campuses have been built in areas of strength of the university, namely: Water, Tourism, Agrofood/Gastronomy, Cultural and Corporate Communication, Health, Cultural and Natural Heritage and composite material.

The campuses act proactively and bidirectionally: On the one hand they capture the needs and interests of the companies and institutions of each sector, making them reach the research groups of the UdG that can meet their needs; On the others they broker research groups with companies and institutions that may be interested in the research and services they offer. As such, they lift much of the administrative burden of third mission activities from the individual academics.

More information:
http://www2.udg.edu/empresa/CampusSectorials/tabid/23788/Default.aspx

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- *Instruments that can lead to scientific outputs in S3 priority areas:* An academic pursuing a career in a traditional university will respond better to instruments that support activities leading to publishable scientific outputs. Policies supporting academic research linked to territorial demands and S3 priorities, through industrial PhDs or collaborative research grants may be most attractive to researchers in these types of institutions.

- *Instruments that facilitate new career paths outside academia,* especially among those at earlier stages of the profession: Perhaps strategically more important, an objective of the policy mix could be to devise instruments that engage early-career researchers (PhD and Post-Docs) and help shape career-paths outside HEIs. It is clear that the traditional career path cannot provide outlets for the

large number of early career researchers. New hybrid work models, which exploit the skills and knowledge of academically trained researchers, could be developed. HEIs and the public administration could partner to understand how to do so, devising tools that connect regional actors to the university and creating and supporting a demand for applied research.

Concluding remarks

This chapter has explored the complexity and different stages of the academic career in European universities. It has highlighted the tensions suffered by researchers in traditional universities, who face conflicting demands in terms of research outputs, teaching activities and engagement with external stakeholders. Although external engagement activities are increasingly recognised in universities' strategic plans and mission statements, most European HEIs lack formal recognition and reward systems for individual academics that cooperate with industry and other external partners.

To understand the challenges faced in the academic profession one must acknowledge three aspects:

- The HE institutional framework varies significantly within the EU;

- The scientific career is currently characterised by an over-supply of early stage researchers (PhDs and Post-doc) and by a decreasing attractiveness of the working conditions;

- We have pointed out that for those researchers who are actually aiming at staying in the traditional university system, there is limited incentive to engage with external actors, as opposed to improving publication records and teaching.

These three facts have important implications for public administrations in charge of S3. First, they need to map the different HEIs in their region (as suggested also in the chapter on EDP) and be aware of which instruments may be more adequate to each. The policy mix needs to be, in general terms, aligned to the individual career incentives either providing direct opportunities for scientific outputs, or lifting the administrative burden of territorial engagement activities as much as possible from individual academics. This should be accompanied by a reflection – from the relevant bodies - on the performance appraisal system followed in traditional HEIs. Last but not least, the increasing competition in climbing the ranks of the scientific profession means that both HEIs and policy makers need to collaborate to create opportunities for differentiated career-paths.

All in all, much of the impact that university staff can have on S3 is still to be exploited. Devising instruments to allow such high-levels skills to support the territory is paramount, both for the success of S3 and for the sustainability of the academic profession.

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Chapter Four: The Entrepreneurial Discovery Process

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Summary

The Entrepreneurial Discovery Process (EDP) is used to identify, refine or review regional S3 priorities and to mobilise actors in the discovery and exploitation of innovation opportunities, throughout the strategy's design and implementation. The EDP relies on stakeholder involvement on the assumptions that knowledge about the techno-economic landscape is distributed across various actors and that the value of top-down policy is therefore limited.

Higher Education Institutions (HEIs) are an important component of the knowledge economy and as such can be key actors in the EDP. This chapter explores how HEIs can contribute to the EDP. It highlights the importance of identifying the right actors within HEIs' and across their diverse missions, scientific domains and functional units. The chapter provides guidance on how to map HEIs, how to identify and engage the right people within them and on how to ensure their sustained engagement in the EDP.

Introduction

In the Entrepreneurial Discovery Process (EDP), S3 stakeholders from the quadruple helix explore innovation and market opportunities collectively, building on their partial but complementary knowledge. The EDP is an inclusive and interactive bottom-up process in which the knowledge distributed across sectors, actors and users is shared to discover potential lines of development. The EDP makes this diverse knowledge available to stakeholders and policymakers who then need to embed its outcomes in the policy process, in pursuit of smart, inclusive and sustainable growth.

The term EDP originally referred to the identification of areas for investment in research and innovation (i.e. S3 priority-areas), through an inclusive and evidence-based process grounded in stakeholders' engagement. However, it has evolved from being a process limited to the identification of investment-priorities in the design-phase of an S3, to a continuous activity, embedded in the strategy's implementation.

HEIs are critical actors for knowledge-based development and this chapter explores how to engage them and make the most of their contribution to the EDP. It is articulated in the following sections: section two highlights the aims and obstacles of HEIs participation in the EDP; section three provides guidance on how to map HEIs, as a first step to identify the right individuals for the EDP; sections four and five look at how to engage HE throughout the S3 policy cycle; section six summarises and concludes.

The involvement of HEIs in the entrepreneurial discovery process

HEIs are key actors in the EDP: according to a JRC survey they are the stakeholders that are most likely to be invited to engage in the EDP and the most likely to participate. Regional officials tend also to be relatively satisfied by the engagement of HEIs and tend to know them fairly well.

However, HEIs do have some distinctive characteristics which need to be understood to improve the impact of their engagement. HEIs tend to have very loose strategies and weak internal transformation levers. HEIs might resemble federations of a multiplicity of actors rather than institutions that can act as a single entity: Faculties, departments and university institutes are often powerful entities with distinct cultures. They have therefore limited flexibility to (quickly) adapt governance mechanisms, reorient thematic and funding priorities or innovate in the education portfolio. Furthermore, in many countries and regions, HEIs operate under tight institutional and administrative environments. Hence, tapping HEIs potential for EDP, as a bottom-up process, may be challenging

There are three points to be taken into account when planning engagement of HEIs in the EDP:

- First, HEIs' engagement and commitment to the EDP will depend on the profile of the institution and their fit within the innovation system. Indeed, from the point of view of research-focused HEIs, there may be a trade-off between local engagement with firms and scientific excellence (See Chapter two of this handbook). Furthermore, matching HEIs and regional companies with a low to moderate absorptive capacity for innovation may lead to frustration and unsatisfactory results.

- Secondly, the operational and scientific timescales of HEIs may not be aligned to those of the private sector, which is structured to respond more quickly to market dynamics.

- Thirdly, since HEIs' degree of participation tends to be among the highest of all types of stakeholders in the EDP, there is a risk of over-representing them at the expenses of other entrepreneurial stakeholders that are more difficult to mobilise (i.e. SMEs). This could lead to a bias in priority-setting, widening the gap between research assets and social or market opportunities.

For these reasons, coordination between industrial and scientific actors may be difficult and may not result in concrete outcomes. The public body in charge of the S3 should design the EDP and the policy-instruments in such a way that enables stakeholders to build on their common-ground, towards shared goals.

Setting the stage: Profiling the specialisation and structure of HEIs in the regional ecosystem

Mapping the innovation ecosystem to identify themes, actors, networks and structures is an important first step for the EDP. This is necessary to avoid engaging exclusively the usual suspects, i.e. those stakeholders better connected to public administrations and engaged with previous policies. When it comes to HEIs, this means engaging not only senior managers (i.e. rectors or vice-rectors) but also academic and functional units or individuals that work on subjects related to S3 priorities.

To this aim, we suggest a two-level mapping exercise, revolving around:

1) Profiling current and emerging themes and collaborative communities

2) Profiling higher education institutions

Mapping HEIs: Identifying themes and collaborative communities

Current technologies enable mapping HEIs, in their ecosystems, at a high level of granularity and with timely updates. Semantic technologies, relying on text mining and machine learning, increase our possibilities to extract meaning from data.

In the case of HEIs, sources of pertinent data currently proliferate with the spread of open data and open science initiatives. These include external sources like project databases (for EU, national or regional projects), bibliometrics and altmetrics , patents, clinical trials, the composition of the student body (BA, MA, PhD), the educational portfolio and data on student placement and careers, startup/spin-off registers as well as labels awarded to research or training entities or intermediary structures (i.e. innovation hubs and clusters). HEIs themselves might also provide information for instance via corporate documentation (i. e. strategic plans, priority areas, etc.) and might have collected useful data e.g. through their offices of technology transfer (TT) on third mission indicators

Box 1: EDP in an emerging field - text mining and HEI survey for the identification of academic experts for Industry 4.0 in Tuscany (Italy)

In accordance with the National Plan Industry 4.0, the Department of Industry of Regione Toscana started a series of EDP activities that resulted in the creation of the Regional Platform for Industry 4.0, an integrated structure aimed at connecting the needs of private companies to the industry 4.0 competences offered by local HEIs and research institutes. The problem was particularly challenging, since Industry 4.0 is a new topic, built around several pre-existing disciplines and technological domains, with no standard definition or perimeter. The initial objectives of the Platform were to characterise the prevalent regional topics connected to Industry 4.0 and to identify the corresponding individual experts (researchers, technicians) in the regional HEIs and research institutes.

To address these challenges, 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, Tuscan researchers, in Industry 4.0 topics by bypassing communication bottlenecks between the Region and the researchers involved

Both methodologies converged and, out 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 have agreed to join the expert database of the Regional Platform for Industry 4.0. Furthermore, 230 private companies were automatically 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.

More information: http://www.cantieri40.it/i40

An analysis and benchmarking of these sources can provide a sound first assessment of strengths and weaknesses, as well as institutional diversity, of the higher education and innovation ecosystem in terms of organisation, people and themes relevant for S3 and

the EDP. It can also enable the analysis of existing networks by mapping collaboration patterns in competitive projects and co-publications, and it could show trends, potentially supporting the identification of emerging priority areas.

The table below provides a first systematic overview of the type of data that may be useful to map HEIs for the purposes of managing an EDP.

Table 1: Mapping HEIs for the EDP: potential data sources
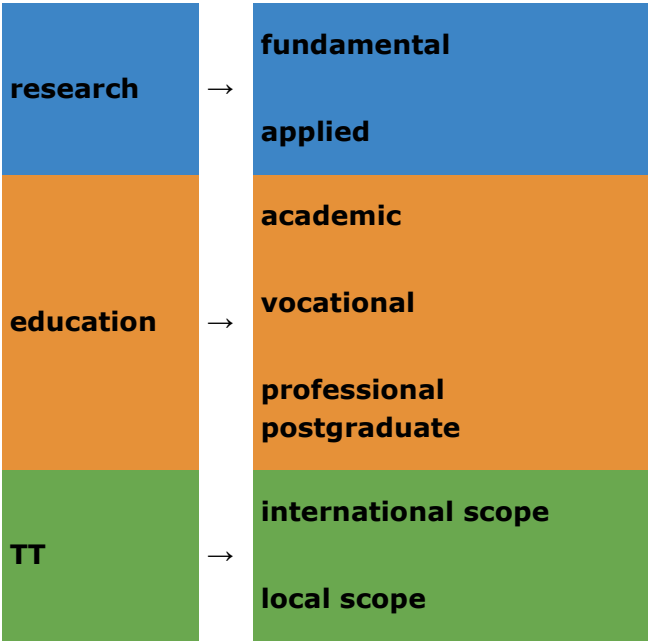
HEIs activities	Data sources
Education	- Student records - Student and graduate surveys (e.g. social profile, employment outcomes, etc.) - Profile of educational/training/placement supply - EU projects in programmes supporting education (ie. Erasmus+, MSCA) - Pertinent prizes and excellence in education 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
Internatio-nalisation	- International co-publications - EU projects with international partners - Participation in international associations and platforms - Strategic plans emphasising international engagement

The afore-mentioned exercise should be accompanied by an institutional analysis of each HEI in the regional system, providing an understanding of the organisational and policy context they operate in, and their respective missions.

To this aim it is useful to assess the engagement of each institution in the main missions of HEIs and in each of their basic subcategories, as suggested in the matrix below.

Table 2: Matrix of broad profiles of HEIs

research	→	fundamental
		applied
education	→	academic
		vocational
		professional postgraduate
TT	→	international scope
		local scope

At the same time, it is necessary to consider the policy framework and degree of autonomy under which local HEIs operate, as explained in Chapter One. For instance, to what degree do the region's HEIs depend on others for funding (i.e. national authorities, regional authorities, research organisms, private sponsors, EU programmes), strategic orientations, HR decisions (i.e. hiring and career paths). Mapping HEIs strategic, financial, thematic and hiring autonomy and practices will enable policymakers to gauge their interests and capacities.

Ultimately this exercise should lead to develop a rough taxonomy of HEIs, allowing the public administration to understand how each institution can best contribute to the EDP.

Higher Education representatives and the EDP: multi-faceted engagement

The analysis suggested in section 3 should provide a first list of suitable HEIs, departments/faculties, units and individuals to contact on the basis of:

(1)   the pertinence of their work and capabilities for potential S3 priorities;

(2)   their position as a strategic actor in the institutional landscape.

Based on such mapping exercise, public administrations should identify whom to mobilise in the EDP, acknowledging that HEIs can contribute with their different missions, activities and disciplines: through their teaching, research and TT activities and across different disciplines, including social sciences, arts and humanities.

HEIs, EDP and education

Students at different stages of learning are indeed a resource to prepare for and involve in the EDP. With the increasing importance of life-long learning in the knowledge

economy, HEIs have to play a crucial role in supporting upskilling and reskilling towards the techno-economic areas of opportunity defined in the S3.

Box 2: Engaging Students in EDP: developing skills, addressing real problems

Saxion university of Applied Science (The Netherlands) is an international-oriented university of applied science that aims to educate smart practitioners. Students are trained to bridge the gap between technology and application. For that reason, Saxion has created the Smart Solutions Semester, which gives students, lectures, researches, companies, governments and NGOs the opportunity to collaborate and conduct projects in inter-professional and international teams. Currently more than 550 students are working on around 100 projects in a diverse range of fields. Students from at least three study-programmes collaborate in groups of six to eight, assisted by a coach and several lectures. They work together in inter-professional teams and on real-life assignments and closely with the client.

More info at: www.saxion.nl/smartsolutions

The University of Macerata (Italy) organises annually the International Student Competition on "Place branding and Mediterranean Diet" in the region of Marche. During this week, students engage with local entrepreneurs and work with them on challenges provided by the entrepreneurs themselves. The competition is organised in collaboration with a local NGO (Laboratorio Piceno della Dieta Mediterranea) as well as several municipalities, which offer their venues to the initiative. The competition comprises lectures with international speakers, study visits to firms, workshops and interviews with entrepreneurs and group-work. At the end of the programme students provide a proposal to both businesses and municipalities to address the challenges they had shared earlier in the week.

While neither initiative is organised under the local S3 umbrella, they both embed the features of engaging students in the EDP and developing the relevant skills set.

More information: Bertella et al. (forthcoming)

HEIs, EDP and fundamental research

Scientists engaged in fundamental research are also relevant to the EDP, as they stimulate a reflection on longer-term priority-setting and related human resources and technological capacities. In less developed innovation systems, they are usually an essential source of international inflows of talent and funding, and a lever for regional positioning, marketing and communication. However, scientists with this profile may be interested in intervening occasionally and ad-hoc to the EDP, rather than engaging in it as a continuous process.

HEIs, EDP and applied research

Researchers with a more applied profile, with experience in technology transfer and collaboration with the private sector, are an essential asset to EDP and a key bridge between HEIs and S3 as a whole. Identifying those researchers, and pulling their networks of innovative companies, is critical to the success of the EDP. It is important not to neglect the community of early stage researchers (industrial and traditional PhDs and Post-docs), as well student and academics who have embarked in entrepreneurial activities.

HEIs, EDP and social science, arts and humanities

The engagement of HEIs in EDP, S3 and third mission activities in general is often conceived narrowly and in relation to STEM subjects. However, S3, and the EDP, require multi-disciplinary inputs. Social sciences, arts and humanities can be critical to provide the economic and social analysis necessary for understanding and framing socio-economic needs, as well as co-defining solutions to such challenges. Furthermore, in many regions cultural and experience-based industries (such as media or tourism) have an important role and particularly in combination with digital technologies, can co-form innovative specialisation domains. Last but not least, the these disciplines are rapidly evolving, and new tools, profiles and methods of engagement with the public and private ecosystem can yield significant impacts, also in terms of social innovation.

Sustaining HEIs participation in a continuous EDP

As with all participatory processes, in the EDP there is a risk of stakeholders' fatigue and special efforts should be undertaken to mitigate this risk. Ultimately, a continuous EDP must be sustained through governance and monitoring systems (see chapters four and six) as well as instruments and initiatives (see chapter five) that engage stakeholders by providing returns to their investment in the process.

The governance system needs to allow a space for bottom-up reflection on the implementation of S3. In so doing it needs to include the right profile of individuals from HEIs, those that are motivated and capable of contributing to the process. At the same time, S3 monitoring itself should embed a participatory dimension, providing a space to comment on the latest monitoring results and to collectively anticipate trends and changes in the environment. In this case again, it is crucial to identify and engage the right HE actors, taking into account those scientists/teachers or administrators closer to the S3 priority areas. The EDP also continues through adequate funding instruments that allow stakeholders to collaborate in S3 priority areas, by refining, reviewing and implementing them. It is critical for funding instruments to respond to the incentive-structure of stakeholders. In the case of HEIs, it is important to appreciate that their response to policy instruments will vary significantly depending on their degree of engagement with research, teaching or third mission activities, as underlined elsewhere in this handbook.

More generally, a continuous EDP requires time, competences and skills that may not be immediately available to local stakeholders, including HEIs. In particular, to support the EDP, HEIs need to develop a level of entrepreneurial and innovation readiness distributed across functions, missions and departments, establishing a common vocabulary with other stakeholders and a common understanding of the policy process.

HEIs in North East Romania – building S3 capacity through the EDP

Universities had an extremely active role in the regional entrepreneurial discovery process (EDP) of North East Romania, participating to several focus-groups, based on a methodology developed by the Joint Research Centre (JRC).

The focus-groups were bottom-up, interactive and inclusive exercises aiming at identifying, on the one hand, the main directions of regional development through smart specialisation (i.e. the niche-sectors with significant competitive and comparative advantage and their main challenges) and the main societal challenges of the region, and on the other hand, innovative solutions for development at local, sectoral and cross-

sectoral level. The focus-groups gathered representatives of the regional quadruple helix from the six S3 priority areas.

The methodology was geared towards identifying and subsequently developing project ideas aligned to S3. From the 129 project-ideas submitted by entities from the region, 22 were directly submitted by universities, while 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.

The Regional Development Agency, building on such efforts, has embedded HEIs in the S3 governance structure, both through their management and through scholars with competences in specific S3 areas. Such engagement is remarkable as the region is characterised by an incipient innovation system, with limited systemic interactions, and HEIs depend largely from national funding.

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

Conclusions

This chapter has explored the key challenges and opportunities related to HEIs' participation in the EDP, and provided practical guidance as to how to engage them. Based on the arguments above, five recommendations can be made:

- Engaging HEIs in the EDP does not exclusively mean involving senior management in the process. Rather, it requires identifying the right individuals, i.e. those than can best identify, narrow down and contribute to each S3 priority. To this aim a good mapping of the local HE system, following the suggestions in section 3, is an essential step.

- HEIs can contribute to the EDP across their different activities, including teaching. Students, in particular, are an important and under-exploited resource for the EDP.

- HEIs can contribute to the EDP across disciplines, including the (so far under-represented) social sciences, arts and humanities.

- For individuals from HEIs to be kept engaged in a continuous EDP, it is necessary to understand their incentive structure.

- Engaging in the EDP requires some degree of capacity building, as HEIs (like other stakeholders) need to develop a common understanding of the process, the policies and their individual/institutional role within them.

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Chapter Five: Funding instruments for Higher Education Institutions

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Summary

This chapter provides an overview of the main incentives that drive Higher Education Institutions' (HEI) decisions with the aim to develop the most adequate funding instruments to increase their territorial engagement. Achieving S3 objectives largely depends on the design of good funding instruments that match stakeholders' (including HEIs) capacities with regional R&I and education needs.

A description of funding instruments targeting HEIs in the European and national landscape is provided. Public administrations and higher education institutions will find examples and recommendations to co-create funding instruments that lead to stronger engagement of HEIs in territorial development.

Introduction

Funding instruments are an important tool of public administration to transform policy objectives into reality. Depending on their design, they might be more or less effective in reaching the intended objectives. Additionally, understanding the incentives of funding instruments in HEIs is key to boost their engagement in S3.

The chapter covers a number of relevant issues to be considered by public administrations orchestrating S3 and managing European Structural and Investment Funds (ESIF)[1] when designing new funding instruments to increase HEIs' territorial engagement.

The chapter is divided in the following sections:

1. The first section describes the types of HEIs and their drivers to engage in territorial development. It provides an overview of the existing landscape of funding programmes and the importance of determining the dependence of each HEI on the different programmes.

2. The second section covers the trade-offs and challenges associated to the definition of S3 funding programmes' topics and the relevance of matching the regional needs to each HEI's research capacities.

3. The final section provides an overview of the key aspects to take into account when defining a good funding instrument, which is sustainable over time and is adequately communicated.

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[1] ESIF channels over half of the EU funding and is jointly managed by the European Commission and the EU countries. They focus in five areas: 1) Research and Innovation, 2) Digital technologies, 3) Supporting low-carbon economies 4) Sustainable management of natural resources) and 5) Small businesses.
https://ec.europa.eu/info/funding-tenders/funding-opportunities/funding-programmes/overview-funding-programmes/european-structural-and-investment-funds_en#thefunds

HEI incentives and drivers

The success of a funding instrument largely depends on its alignment to the incentives and ambitions of the targeted beneficiaries. The first step when designing new funding instruments is thus to identify the drivers and the current funding instruments to which HEIs are responding. Those two elements shape the context into which S3 funding instruments have to blend.

Indeed, the HEIs of a given region can be very diverse in their objectives and ambitions, and not equally well-aligned with S3 objectives. While some may be meaningfully "place-based" others may be more national or internationally oriented. Therefore, understanding each HEI's scope of action is paramount to design successful funding instruments. Regions might host a variety of HEIs, including:

- *Research-intensive institutions with strong international academic visibility*. Their main driver is generally the academic recognition by the international peer-community, attested by international rankings, bibliometric indicators, awards or 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 region's international positioning, attractiveness and development of R&D intensive fields.

- *R&D-oriented institutions with a strong network of industry partners from the region and outside*. These are technically oriented institutions that combine research activities, graduate training and knowledge transfer. Even if they have proved to be very good at supporting regional R&D, this is not their exclusive geographical scope of actions, which is not regionally bounded. Usually they are incentivised by programmes that boost collaborative research and offer comprehensive curricula establishing collaborations with national experts in education programmes. Understanding the geographical scope of action of HEIs will therefore be key to set up successful collaborations in the S3 context.

- *Universities with a regional outlook in their research and education supply.* These universities might target mostly local students and will be more inclined to look for an active association with the local professional fabric, both to facilitate graduates' entry in the labour market, but also to innovate in the educational programmes through partnerships with local actors. Their incentives ranges from programmes to collaborate with local business and technology transfer, contracts with local governments departments, service provision, collaborations for business traineeships or industrial PhDs.

- *Higher education vocational institutions*, which are potentially good partners for the regional government for professional integration and development of entrepreneurship-training activities. They offer tailored education well adapted to companies need with important flexibility to respond to the skills needed, making of the incentives to collaborate with local companies their main driving force. The collaborations with local public and private stakeholders to attract and employ pupils are as well an important driver.

Acknowledging the diversity of HEI in a region can be decisive. In this respect, a region should consider if funding instruments have the objective of supporting specific organisations or rather of supporting R&D activities more in general. The former is easier to manage by public administrations but might create undesired outcomes such as public funding dependency. The latter is more sophisticated in its design but results and impact

are more difficult to measure. Both objectives might be complementary or lead to unintended tensions. For instance, if R&D excellence is pursued and the best academic partners are not within the region, it may necessary to support collaborations with HEIs outside the region to develop the local R&D system, hence directing public resources to non-regional actors.

Classifying funding instruments: source and typology

The design of new funding tools should be based on a good understanding of the existing landscape of funding programmes, which varies across Europe and across HEIs.

The mix of funding sources varies considerably across HEIs, yet typically it includes a combination of the ones described section, which are classified by source and typology.

Funding instruments by source

- ***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 is extremely variable across countries. It ranges from highly decentralised countries where regions provide core funding to HEIs, to highly centralised ones where funding is nationally managed. The way in which the core funding is shaped and managed by public administration is key to shape incentives. For example, multi-annual financial frameworks make it easier to introduce long-term objectives and programmes. Result and impact targets also introduce important incentives to promote collaborative or multi-disciplinary research, university-business collaborations or internationalisation dimension.

  - *Competitive calls* are a fundamental instrument of public administrations to strategically stimulate how HEIs contribute to tackle regional or national challenges and contribute to strengthen the R&I system. HEIs are highly dependent on these calls to promote R&I collaborative projects, build their international networks and strengthen their capacities to participate in EU platforms and projects.

The level of dependency of HEIs on such schemes is usually very high. Therefore the design of new funding programmes has to be carefully considered not to conflict or overlap with existing programmes orientations.

- ***European Structural and Investment Funds (ESIF):***

  ESIF constitute the most important EU funding instrument to tackle socio-economic disparities within the European Union, through five main programmes:

  – European Regional Development Fund (ERDF)

  – European Social Fund (ESF)

  – Cohesion Fund (CF)

  – European Agricultural Fund for Rural Development (EAFRD)

  – European Maritime and Fisheries Fund (EMFF)

These EU funds are managed by national or regional administration in close collaboration with the European Commission.

HEIs are among the main beneficiaries of ERDF calls under Thematic Objective 1 (Gianelle et al. 2017), mostly focused in funding research and innovation projects, technology transfer or collaborative partnerships with business. However, the ESF support to human capital for innovation receives much lower budget and is very unevenly distribute across the EU, even if multi-fund Operational Programmes using ERDF and ESF provides an opportunity to address research and education in a more integrated way (Edwards et al, 2017). In addition, synergies between European Structural and Investment Funds (ESIF) and other funding instruments have been encouraged to strengthen the R&I system and the investments' impact (European Commission, 2014).

- ***European competitive funding instruments***:

Horizon 2020[2] is the main EU funding programme for research and innovation. It encourages, especially in research-intensive HEIs, collaboration with other European stakeholders to overcome key EU challenges. The relevance and weight of this funding in HEIs varies depending on the type of institution (see notably 1.1) and the type of region. Other elements such as the previous experience and participation in international networks are equally important. Erasmus + programme is as well an important part of HEI funding, shaping mobility, education innovation and networks. The majority of EU funding programmes tackles either research and innovation or education, with a few exceptions such as the EIT-Knowledge and Innovation Communities[3] and the Marie Skłodowska-Curie Actions[4].

- ***Other funding***:

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

Funding instruments by type

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. Their variety derives from the diversity of targeted objectives, from R&D to skills-building or entrepreneurship support. The literature provides extensive list of such instruments, depending on specific contexts and settings:

- Classifying policy instruments according to their main actions: (a) nodality (position in the social network to reinforce flows and exchanges); (b) authority (legal or regulatory power); (c) treasure (provision of money or financial

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2 Horizon 2020 is the main EU Research and Innovation programme with €80 billion for the period 2014 to 2020. It is centrally managed by the European Commission allocating the funds through competitive call for proposals targeting different type of beneficiaries.
https://ec.europa.eu/programmes/horizon2020/what-horizon-2020

3 The EIT's Knowledge and Innovation Communities 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
https://eit.europa.eu/activities/innovation-communities

4 The Marie Skłodowska-Curie actions (MSCA) provide grants for all stages of researchers' careers to encourage transnational, intersectoral and interdisciplinary mobility
https://ec.europa.eu/programmes/horizon2020/en/h2020-section/marie-sklodowska-curie-actions

subsidies); (d) organization (structuring of skilled actors) (Radosevic & al. 2017, Chapter 13)

- Delivery instruments grouped by project type, from clusters and key enabling technologies to innovative public procurement practices (European Commission, 2012, Annex II)

The mix of the aforementioned instruments will differ substantially across HEIs, leading to different funding frameworks for regional administrations to intervene. There will be higher room for public administrations to orient HEIs activities in those cases in which regional funds constitute an important share of HEI funding. If this is not the case, shaping new instruments can still have a significant effect to facilitate missing connections and help steer existing dynamics in line with regional interests.

As shown in chapter 4, a good mapping of HEIs in the region is essential to maximise their role and impact on S3. In this paragraph we show that we also need to understand clearly their funding framework if we are to devise appropriate instruments.

Challenges in defining funding instruments for S3

As highlighted throughout the Handbook, S3 relies on a participatory bottom-up process to identify thematic priorities with the quadruple helix actors, including HEIs. The implementation is subsequently done through the design of calls for proposals with selection criteria for projects to fall under the selected S3 priorities and contribute to the achievement of S3 objectives. Nevertheless, the main challenge in the definition of a good funding instrument lies in the selection of topics that will be funded and will contribute to the selected S3 priority areas.

Which S3 priority or sub-priority area to fund?

An important aspect to consider is the level of granularity of the topics to be eligible in a call implementing S3. Recent evidence shows that calls generally address all the selected priorities within S3 and are not specific to one priority area (Gianelle & al., 2017). However, topics that are defined too broadly may scatter scarce resources failing to achieve the critical mass and differentiation aimed in S3. Conversely, topics that are defined too narrowly might hinder other emerging areas creating a lock-in effect.

Setting the right balance between narrower and broadly defined topics is a highly contextual matter, but some general guidelines can be considered:

- *Resource-intensiveness of the S3 priority area*. A narrower definition of topics would be more beneficial if the S3 priority area is highly dependent on the existence of a critical mass of beneficiary organisations and relies on costly infrastructure or equipment.

- *Maturity of the EDP*. The definition of more precise topics becomes less risky as the EDP matures and proves its efficiency, the skills-needs are better identified and the regional sectors are more advanced.

- *State of the art progress.* A narrow definition of topics might become rapidly outdated in sectors in which scientific knowledge advances quickly, giving place to a mismatch between the scientific knowledge, the social priorities, and the activities to tackle them.

Main choices in the definition of funding instruments

The diversity of existing funding instruments might give the impression that the secret to successful collaboration with HEIs resides in finding "the good" funding instrument. However this may be misleading for two reasons. Firstly, funding instruments actually fall under a limited number of categories. And secondly, the success of a funding scheme depends not so much on the type of instrument as such but in the previous analysis which leads to the correct identification of the needs and is a highly contextual and specific exercise.

This subsection provides guidelines to design efficient funding instruments that can be applied to different regional contexts and objectives. The following questions should be answered when defining a scheme:

- *Why* is the funding needed? This question should help identify the sector of activity that aims to be improved and supported (research, teaching, communication, etc.). It should be based on a previous diagnosis and strategic choice regarding the key leverage effect needed in the system.

- *What* is being funded? Funding instruments for HEIs can only fall under three main categories: (a) people and skills (salaries, project-based researchers or training for new skills); (b) infrastructure and equipment; (c) networking and connections (international mobility, events, conferences, communication, meeting venues).

- *How* it is being funded? The approach might vary between competitive calls or performance-based funding. In the former, the criteria introduced in the application process should be carefully considered by public administrations as it might determine the role of universities in S3.

- *Who* is being funded? Considering if the scheme in targeting individual researchers, research groups or institutions is key to introduce the needed stimulus in the R&I system. This choice can determine individual researchers involvement in S3 that strongly depends on HEIs internal management. As an example, the limitations to hire new personnel of funded projects may strongly discourage them to participate in R&I projects.

The success of a funding instrument depends on the alignment between the instrument and the need it addressed, which ideally should be identified through a co-design process with the potential beneficiaries. A careful match between the S3 objectives and the actors' needs (including HEIs') should be pursued in order to avoid the automatic replication of instruments that where successful in different regional contexts. In particular, in regions were the institutional capabilities are limited the choice should be driven by the best policy matches rather than on the best policy practices (Crespi & al. 2014, p. 29).

Indeed, even if a very large majority of regional funding is still targeting direct support to RDI projects (Gianelle et al, 2017), it would be interesting to diversify the S3 instruments to tackle, for example, skills shortage or misalignment between educational offer and industrial needs[5]. The following aspects could be considered when considering the diversification of instruments:

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5 The EC proposal for the programming period 2021-2027 includes as specific objective for ESIF "developing skills for smart specialisation, industrial transition and entrepreneurship"

- When stimulating employability and addressing human resources needs in a region, specific schemes could be considered to fund academic staff and facilitate the involvement of local companies and entrepreneurs in education activities or curriculum design. This is key in a context with increasing importance for universities to integrate life-long learning in curricula, not without obstacles.

- When tackling the weak connections between researchers and regional entrepreneurs, it might be useful to consider networking schemes and means to recognise the participation of researchers in such collaboration projects

- When addressing SMEs' difficulties to access university knowledge and infrastructures, introducing vouchers to pay for specialised university services, funding hybrid organisations between university and business or placing master and doctoral students in companies can have important leverage effect.

- When targeting the lack of funding schemes alignment or overlap, it might be particularly important to emphasize the collaboration between different regional government departments to overcome silo effects.

- When the university has weak internal coordination and strong silo approach in accessing funding instruments, specific schemes for projects to bring together research, innovation and education activities, facilitating collaboration hubs within and outside the university, enabling piloting facilities or multi-disciplinary research institutes could be promoted.

Box 1 - The response of Centre- Val de Loire (FR) to attract international researchers

LE STUDIUM is a regional agency that hires highly skilled international researchers to strengthen international scientific exchanges and attractiveness of the region. The initiative is highly successful and a reference for other regions in Europe, having attracted more than 170 researchers from North America, South America, Asia, Africa, Oceania and Europe, with 5% of researchers settling in the region after the end of the programme.

Since 2013 LE STUDIUM is strongly integrated in the S3 to reinforce the international partnership of the Ambition Recherche Development (ARD 2020)[6] program, a regional initiative promoting university-business collaborations. The aim is to attract researchers to the ARD teams and stimulate their internationalisation encouraging their participation in H2020.

The importance of light-weight and well-publicized funding instruments

The chapter has underlined the importance of understanding the context in which HEIs operate, their drivers and the existing funding instruments. However this is not enough, as carefully designed funding instruments depend on very pragmatic considerations related to the way in which they are deployed and implemented.

In a context of complexity of the funding programme landscape, it is of outmost importance to consider the targeted beneficiaries perspective and understand their

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https://eur-lex.europa.eu/resource.html?uri=cellar:8d2f7140-6375-11e8-ab9c-01aa75ed71a1.0001.02/DOC_1&format=PDF

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

challenges, if regional needs are to be met. Some basic considerations for the success of funding instruments are described below:

- *Interaction with beneficiaries is important not only at the moment of identifying the topics and needs*. Public administrations managing funds should have a good understanding of the bureaucratic constraints that the academic staff is facing and are rarely perceived from the outside. Having a sample of potential users test the design of a call and point out practical difficulties is a good practice to identify unsuspected technical obstacles. The quality of the call design is key when the applicants have time and resource constraints, and might prove even more crucial for actions involving HEIs and SMEs.

- *Regularity over time*. Designing funding instruments is not the place for originality or frequent changes. The H2020 success is partly explained by the regularity, common templates and platforms to answer call for proposals, which enables a proper planning and learning process over time.

- *Targeted communication*. The variety of funding schemes at regional, national and EU level makes difficult for researchers to understand calls' specificities, type of activities funded or eligible knowledge area. The availability of specific offices in HEIs to select, filter and target the information on calls targeted to researchers has proved to work very well in improving the success rates in H2020. The specialised skills of this staff, with knowledge in collaborative projects, proposal drafting and preparation is a key issue to be considered.

- *Long-term perspective*. As a general rule, it is important to ensure the long-term sustainability from the design phase of the instrument to avoid financial tensions and ensure complementarity with other funding instruments. This is particularly relevant in equipment or laboratory infrastructure funding, to funding shortage, the mismatch of staff capabilities or unsustainable business plans.

- *Monitoring of results*. Public administrations should regularly assess if the initially planned results are being achieved by the funding instrument, in terms of type of beneficiaries mobilised, project characteristics or researchers attracted. Shaping the funding scheme to the specific features and governance of HEIs would increase their impact in S3.

Conclusion

The chapter has provided some insights into the main features that public administrations should consider in the design of funding instruments to achieve S3 objectives, emphasising that there is no one magical solution that fits all regions. The efficiency of a funding scheme depends on its capacity to match policy objectives with beneficiaries' needs.

Specific recommendations have been provided in the chapter to ensure the design of a good funding instrument, through:

- A good framework analysis of the drivers of the HEIs in the region and the match with S3 objectives and priorities

- Making sure that the intended instruments insert smoothly into the existing funding landscape by limiting overlaps, redundancies and complexity.

- A balance between narrow and broad topic-definition that has been tested with the actors, with a good identification of relevant academic competencies.
- Simple and regular procedures, mixed with targeted communication.

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Chapter Six: Higher Education Institutions and their Role in S3 Governance

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Summary

Governance is a complex and highly context-specific issue. It is central to the S3, as it determines the decision-making processes that will drive the strategy. The governance system should include a well-balanced representation of stakeholders, HEIs among them, to ensure a distributed leadership, co-ownership and long-term commitment for the achievement of S3 objectives.

The chapter emphasises the importance of HEIs being involved in the early definition of the S3 governance structures to ensure a meaningful and coordinated contribution from the three university missions. The benefits of the involvement of the larger university community, from managers, researchers or entrepreneurs in S3 governance levels (strategic, technical and bottom up) is described. Finally, examples from different EU regions illustrate how challenges associated to S3 governance have been addressed in specific geographical contexts.

Introduction

Governance is one of the Achile's heels of S3 for regional governments and other territorial actors sharing the leadership of these strategies. The S3 process is based on the principle that entrepreneurial knowledge is shared among actors in the territory, hence the identification of priorities for investment should not be left to the public administration alone (See EDP Chapter). Needless to say, the coordination of actors both in the identification of priorities and subsequently their implementation, requires an adequate governance structure that involves stakeholders, including HEIs.

What is the role of universities in the S3 governance? To answer this question the chapter will look at the core elements that shape S3 governance: definition, governance system levels and challenges. The chapter proposes potential contribution of HEIs to these challenges, with an indication of the roles that different actors, within universities, could take. Examples are provided on different approaches taken by regions to address the aforementioned governance challenges and the particular role taken by HEIs.

Governance of S3: Definition and levels

Governance is a strong context specific issue, being organised differently across EU territories. One of the novelties of S3 lies in the fact that stakeholders should actively participate in the construction of the most adequate governance arrangement considering local specificities.

What is governance? First, it should be underlined that governance is frequently mistaken with government or the public administration, one of the actors interacting with regional stakeholders in a determined governance arrangement. Governance can be

understood as a mode of coordination of interdependent activities[1]. S3 has opened the process of policy making to other actors, willingly entrepreneurial and knowledge-creating actors.

This opening process requires reflecting on the basic characteristics of a 'governance system' as defined in the 'Guide to RIS3'[2] comprising three levels:

1. *Strategic level.* It is responsible for the overall performance of the strategy and steering groups are in charge of it. The main tasks would typically include setting objectives and monitoring activities, selecting the members of the Management Team, supervising the work-programme, political and institutional support, and liaising with the European Commission. These groups are usually composed by business community, local and regional government members and key innovation actors.

2. *Technical-managerial level*. This level is usually in charge of small management teams responsible for implementing projects under the guidance of the strategic level and the steering group. The usual tasks of this level include providing performance reports, acting as secretary for the steering group or coordinating actors for project implementation.

3. *Bottom-up process.* This level refers to the governance system mechanisms that enable to engage local actors with the purpose of building consensus in S3. One of the challenges in the S3 governance lies in the involvement of end users (entrepreneurs) from the beginning of the policy process. Different modes of working groups have the role to inform the strategic level about emergent discoveries.

S3 governance arrangement could be enriched by *experimental governance*, understood as 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[3]. Pilot projects play a central role when developing this experimental approach, together with action-learning processes (later explained in the chapter). Both facilitate the engagement of new actors and help overcoming barriers to advance in the experimental approach of S3.

Role of HEIs by S3 governance function

This section highlights some of S3 governance dimensions to which HEIs can contribute. The following aspects have been identified:

- *Involvement of the highest political level and horizontal coordination*

- *The multilevel governance dimension*

- *The construction of a shared vision and process knowledge development*

- *Funding*

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1 Jessop (1998)
2 European Commission (2012)
3 Radosevic et al (2017)

Involvement of the highest political level and horizontal level coordination

The involvement of the highest political level in S3 is of outmost importance, showing its strategic nature and paving the way for the involvement of different ministries or sectors. However, the risk of a unique government department capturing the S3 process should be avoided. The involvement of different departments in the strategy introduces a broader consensus on the relevance of S3 for the region, yet it usually entails the redefinition of decision-making arrangements and bodies.

Integrating different departments increases the capability of the strategy to reach a wider range of stakeholders, requiring adaptive HEIs to evolve with the S3 governance and influence it. However, the coordination and agreement of government departments is not exempt of difficulties and conflicting interests, and it is not facilitated under the current ESIF framework. It requires an important change of installed cultures and internal dynamics.

HEIs are used to interact with different government departments, i.e those in charge of education, research and economic development policies, as well as those participating in different ways to educational programmes and research activities. Such experience could be honed for inter-departmental governance of S3.

Box 1: Basque Country - S3 horizontal coordination and involvement of HEIs

In the early stages of the Basque Country S3, the Government Department of Competitiveness and Economic Development was the one orchestrating the process, being the closest to companies and in charge of reorganising the science and technology network. Over the years Orkestra[4] had built a solid relationship with this department with regular meetings between policy makers and researchers. However the framework and diagnosis analysis developed in the SPRI[5] and the later consultation process with other government departments, showed the importance of involving these departments in the process.

An Operational Working Group directly depending on the Presidency Department was set up, taking the leadership of the S3 process. This became a key turning point in the S3 governance definition, moving from a single department leadership to a distributed leadership with multiple government departments. It required however a redefinition of Orkestra's position in this new governance space, building a new relationship with the Presidency Department to maintain their active participation in the construction of the new governance arrangements[6] .

The multilevel governance dimension

The diversity of spatial levels of governance to which S3 are assigned and the differences in governance structures across EU member states[7], together with the involvement of the various actors around the quadruple helix, makes of multi-level governance an important dimension to consider.

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

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

6 Aranguren et al. (2016)

7 Kroll (2015)

Though in the S3 context, multi-level governance embraces also the need for multi-actor involvement, we will focus on the aspect of vertical coordination challenge. Multi-level governance acknowledges then the existence of multiple policy levels (regional, sub-regional, national and EU) targeting research and innovation policy support, which introduces the challenge of coordinating S3 measures with other political levels and the use of funds to meet policy targets[8]. Additionally, effectively connecting the multiple spaces where entrepreneurial discovery might emerge in the region should be as well regarded.[9]

The multilevel dimension of S3 challenges previous decision-making arrangements and bodies in place[10], being a potentially very beneficial yet complex exercise. If we consider the different HEIs orientations (See Funding chapter), some more international oriented and others more regionally rooted,, they can support the creation of multi-level governance spaces. Furthermore, cities constitute an interesting laboratory to involve stakeholders, and the important influence of HEIs in cities social and cultural life makes them particularly well placed actors to become such urban laboratories that can support S3 governance.

Box 2: Centre Val de Loire - Integrating human capital in S3 in national-regional coordination

In France Higher Education is a national level competence, it is the state that provides block funding to universities, ensuring equal access and a balanced development of universities across the country. Centre-Val de Loire has engaged in the elaboration of the SRESRI (Regional Scheme for Higher Education), Research and Innovation, a coordinated effort of all higher education and research stakeholders of the region, to better connect existing capacities in international networks and reinforcing interregional collaborations to irrigate the region.

This effort has been reflected in being the sole French region that has integrated the human capital dimension as a S3 priority. The SRESRI has been defined in cooperation between the key R&I actors, considering the complementarities with the national strategy and key regional plans, such as Regional Pattern for Economic Development, Innovation and Internationalisation (SRDEII), Innovation (RIS3), Territorial Planning, Vocational and professional training (CPRDFOP).

The construction of a shared vision and process knowledge development

A shared vision is one of the main elements to make a strategy succeed, understood as a common understanding of the differences and not as a uniformity of perspectives, which would not be desirable and would often jeopardize collaborative processes. HEIs can help construct a shared vision, firstly contributing to find their own role in the process that will require negotiation capabilities and secondly through research approaches, providing theoretical frameworks and knowledge on participatory processes.

In addition, the emergent and experimental features of the entrepreneurial discovery process and the construction of governance for S3 in each own require the so-called *process knowledge* and *facilitators* to make it happen (See EDP Chapter).

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8 Koschatzky and Kroll (2009)
9 The relevant sub-regional governments can range from municipalities to county and provincial governments, with municipalities having a particularly prominent role. (Estensoro and Larrea, 2016).
10 Estensoro and Larrea (2016)

- *Process knowledge:* is usually a tacit knowledge that can be understood as learning and experience (knowledge in action) that actors involved within S3 governance and facilitators of S3 processes must develop.

- *Facilitators:* are those that individually or in a group context, assume the task of generating conditions for territorial actors to reflect, decide and act[11]. The facilitators carry out their process of reflection, decision and action subject to the agents' processes and to this end have a series of capacities.

HEIs can be good facilitators in the construction of S3 governance considering their research, education and innovation activities with multiple actors within and outside the region. However, the challenge of continuous engagement of actors (See EDP Chapter) requires specific facilitation skills that HEIs could invest in acquiring.

Box 3: Basque Country: social researchers role in the construction of shared S3 vision and development of process knowledge (Gipuzkoa and Bilbao cases)

The province of Gipuzkoa (Basque Country), currently developing an Industry 4.0. program for SMEs, is a good example of a multilevel governance construction. Researchers working with an action-research approach helped in the definition of roles of the provincial council and the county development agencies in a new collaborative governance structure.

The process was based on *reflection and action cycles* developed between researchers and various Directors of the council, staff members (civil servants), mayors and directors of county agencies. The process included three workshops (held monthly) to learn about each other and make differences in perspective and conflicts of interest explicit. Three additional workshops were organised to negotiate their individual role in the collaborative governance. The agreement that institutionalized the new governance was signed in June 2017.

In the case of Bilbao, through action research workshops policy makers of the economic development agency of Bilbao (Basque Country) defined the facilitation actions they needed to take to impulse EDP. The action-research approach provided methodological frameworks to help move from the operational discussion of challenges when facilitating urban EDP to an abstract discussion and inversely, ultimately facilitating decision-making. As an example, this process was used to provide an analytical framework to help define the role and features of facilitators. Once reflection was brought back to the EDP process, different facilitation roles were identified according to the policy-makers capacities, discussing and agreeing on their particular roles in the EDP meetings.

Funding

Synergies between ESIF and other funding sources can improve the implementation of S3 and increase its impact (See Funding chapter). Integrating funding synergies within S3 governance, that is integrating a more strategic and coordinated approach in the access to EU and other funds to implement S3 objectives, could be beneficial to bridge some of these difficulties. This could be particularly relevant to enhance the outward

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11 Costamagna and Larrea (2017)

looking perspective of S3 and for regions with weaker research and innovation systems that have difficulties to access EU collaboration networks and participate in H2020[12].

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. Ensuring as well that the experience developed by individual researchers in EU projects has a leverage effect in the R&I system and contributes the implementation of S3 could have important impact.

Box 4: Basque country and Navarre- Integrating synergies at the core of S3 governance

Both regions have created a body within the current S3 governance structure to channel the information on EU policy development and funding programmes. In the case of Navarre, the Permanent Discussion Fora have been created to channel the information coming from the Brussels regional office around the S3 priorities. In the case of 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 gathering different stakeholders capacities in the region.

HEIs are important part of these groups, bringing their international networks and knowledge to S3 implementation.

The roles of HEIs actors in S3 governance

The willingness of university managers to engage in S3 process is not enough for HEIs to be an active player in its governance system. University autonomy, academic freedom of researchers and managerial systems can hinder individual HEIs' actors' involvement in territorial development.

The diverse actors within the higher education community can contribute to the S3 governance levels taking different roles and bringing complementary expertise. We here introduce a simplified tripartite taxonomy of HEIs actors, that is: entrepreneurs, managers and researchers and explain how these different HEIs' profiles can contribute to S3 governance.

The role of entrepreneurs

Even if HEIs managers might be engaged in S3 and view it as a strategic process for their institution, the complexity of university structure, hierarchy and governance make it challenging to engage individual researchers in entrepreneurial processes in collaboration with other regional stakeholders. As indicated in the Careers chapter, scientific production and peers recognition are among the main incentives in researchers' careers. Universities can introduce organisational measures or internal incentives to boost such entrepreneurial role among researchers, for example through measures for closer university-business collaborations.

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12 Conte and Ozbolat (2016)

Box 5: UPNA Contributing to S3 governance through multi-disciplinary knowledge

The Public University of Navarre (UPNA) has put in place a number of research institutes aligned with S3 priorities that bring together university research capacities. The promotion of research institutes has been a coherent and coordinated university response to engage the research community in S3 governance, particularly in the sectorial groups and thematic clusters. This constitutes an important step forward for the university, to increase the integration and coordination with the productive fabric of the region and stronger collaboration between technology centres and research institutes in S3 fields such as Automotive and Mechatronics or health.

The role of managers

As we have seen throughout the handbook not all universities engage equally in territorial development. The negotiation of S3 governance arrangements will benefit from the involvement of highest university hierarchy, such as Rectors or Vice-rectors, to bring a more coordinated approach to regional challenges from the three university missions, and to ensure education is a key element of the strategy. Being active members in the strategic governance levels is an important effort from HEIs managers to generate internal change, bringing S3 to the institution's agenda and internal managerial bodies.

Box 6: Navarre - Key role of university managers in S3

In the case of Navarre region both UPNA and UNAV rectors and Vice-rectors are highly engaged in S3 governance and more importantly have understood the valuable contribution they can make to its definition and implementation. As a result education has been included as a transversal S3 priority. The UPNA has integrated S3 in the core of the Strategic Plan 2016-2019, in which the educational offer has been re-designed to better respond to S3, adapting to social demands and streamlining the existing degrees.

The role of researchers

The contribution of researchers to the S3 governance bodies is not limited to contribute to the bottom-up processes within specific working gropus. Social scientists can acquire new roles moving from the more traditional function of conceptual framework providers- on what should be and how to develop S3- to an emergent co-generative role. The use of action-oriented participatory processes to co-construct solutions to solve specific stakeholders' problems in developing S3[13] place them as important actors in working together with policy makers to build solutions associated to governance processes.

Box 7: Basque Country: social researchers in the definition of S3 roles

The example builds on the one previously explained earlier in the chapter*.*

In the construction of the multi-level governance mechanisms in the province of Gipuzkoa (Basque Country) two dynamics took place with the facilitation role of social researchers. While the people in the hierarchies of the different government levels and agencies were constructing the shared vision for the agreement, the staff of the agencies worked with members of the Provincial Council to develop a governance framework to integrate small firms. Conflict emerged in this space in the different

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13 Karlsen and Larrea (2016), Aranguren et al (2012)

interpretations of the role of county agencies in such policy process.

The County Council agencies' members argued that their role went further than raising awareness on the need to innovate among small firms. As a consequence a new role of catalyst was agreed, meaning that they were the referral for small firms to understand their challenges and derive them to specialised experts in each field. This was named as the "family doctor" role.

Researchers role developing the conceptual exercise enabled the discussion around the county council agencies' roles and reach a consensus on their "family doctor' role by the rest of government levels. This role has been understood as key for a new governance that facilitates bottom up processes where small firms have direct participation.

Concluding remarks

The chapter has explored the many roles that universities can have in the S3 governance mechanisms. The most relevant challenges associated to the definition of governance structures and spaces have been highlighted, pointing out the potential roles that actors working within HEIs can take and how can be activated.

The main lessons that can be extracted from the chapter can be summarised as follows:

- Governance arrangements are unique, imperfect and of evolving nature, and should be understood as a process towards a shared-vision, discussion and agreement on the best governance arrangement at different times between stakeholders.

- S3 brings a different approach to policy making and to the role of HEIs. The way in which different actors participate in the definition of governance arrangements may determine to the way they contribute to territorial development.

- The differences in university profiles and their incentives should be well understood by regions to construct governance arrangements where they can find their own place and voice.

- S3 would benefit from the involvement of the broader university community bringing their capacities on research, co-generation, triangle of knowledge collaborations, international networks and innovation dynamics.

- HEIs can support experimental governance modes to facilitate processes to legitimate different stakeholders' role in the S3 governance system.

- Action research can help construct new governance modes in which policy makers and researchers take ownership of the process.

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Chapter Seven: The role of Higher Education Institutions in Monitoring S3

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Summary

Monitoring is one of the most challenging aspects of S3, but one where HEIs can potentially contribute significantly. In this chapter, we present some key principles and a number of initiatives which highlight the role that HEIs can have in developing S3 monitoring systems, either in parallel or in collaboration with public administrations. These initiatives fall into four categories:

1) The design of monitoring systems for S3 and the related data-collection and analysis.

2) The involvement of HEIs in the participatory activities related to monitoring.

3) The development training and education programmes.

4) The stimulation of an intellectual debate on monitoring.

The main aim of the chapter is to provide examples to public administrations and HEIs, in order to promote a reflection on their cooperation in S3 monitoring, while considering the incentives and obstacles that these activities imply for HEIs.

Introduction: HEIs and S3 monitoring

The academic and policy literature on the role of the Higher Education Institutions (HEIs) in innovation policy has been growing in the last decades, offering different perspectives on their interaction with the innovation ecosystems. Whilst there is evidence of the critical role of HEIs in support of public policies,[2] their role in specifically supporting monitoring processes is yet to be fully explored. This chapter is a first attempt in this direction, and provides practical examples about the potential contribution of HEIs.

Monitoring is critical for S3 to deliver its objectives. A sound monitoring system must reflect the S3 logic of intervention: It must be able to measure whether the objectives of the strategy, articulated by priority, are being met through the different policy instruments. As introduced by Gianelle et al[3], an S3 monitoring system should be articulated (at least) through output indicators (direct products of policy interventions) and result indicators (socio-economic effects in target groups), reflecting the specific objectives of the strategy. However, monitoring systems can also comprise wider tools, including surveys, data visualisation, qualitative analysis, and insights from stakeholders.

Furthermore, S3 monitoring serves different purposes. In a first instance, monitoring reflects the need for public accountability, as it allows citizens to know whether public money has been used wisely and legitimately. At the same time, monitoring is a communication device, to keep stakeholders informed and engaged in the strategy's development. However, as S3 is a transformative strategy, one in which knowledge

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1 The authors would like to thank Dr Elisa Gerussi for her insightful comments.
2 European Commission (2011)
3 Gianelle et al (2015, 2016)

creation, dissemination and diffusion are at the core of territorial development, monitoring can also capture positive spillovers derived from S3 implementation, that is monitoring can become a learning tool.[4] Therefore, the purpose of monitoring is to both measure the effects of public policies and reflect on them to improve their efficiency and effectiveness.

HEIs provide a large reservoir of analytical and research skills that are essential to monitoring as a learning tool. Engaging HEIs in S3 monitoring (through consultancy agreements, training, research or traditional education, as well as other activities) can in fact be considered a form of knowledge transfer to policy support.[5]

Acknowledging the relevance of monitoring for S3, the JRC has developed a free Massive Open Online Course (MOOC) on *Monitoring Smart Specialisation* to guide regions and member states in this task.[6] This chapter aligns with the structure of this MOOC, and it presents a number of practical ways in which HEIs can support public authorities when designing, implementing, improving, and/or analysing their S3 monitoring systems.

The following sections describe four main avenues of collaboration, with examples from EU regions and HEIs. Specifically, section two looks at the potential contribution of HEIs towards the design, data collection and analysis of S3 monitoring; section three describes the participatory nature of monitoring and the role of HEIs within it; section four looks at the creation of human capital for monitoring, through training and education; section five highlights the importance of HEIs as champions for evidence-based decisions; section six looks at the incentives and obstacles for HEIs to engage in S3 monitoring, and section seven concludes.

Monitoring systems: design, data collection and analysis

Smart Specialisation requires monitoring systems capable of supporting the public sector and stakeholders in their learning processes. Building a monitoring system requires translating the logic of intervention into a set of analytical tools that provide information of how the S3 is being implemented and the effects it is generating. At the very least, a monitoring system comprises a set of output and result indicators organised by priorities. However, these are (and should be) often accompanied and enriched by ad-hoc surveys, analysis of open-data, analysis of administrative data, as well as qualitative focus groups, or interviews of key informants. Carrying out these activities requires research and analytical skills that are at the core of HEIs and that can complement the administrative and policy knowledge embedded in the public administration. Furthermore, such activities can be designed to serve both policy and research purposes, as the data collected and analysed for S3 monitoring can serve as a basis for academic outputs.

Cooperation idea 1: HEIs supporting the design of monitoring systems

Designing a monitoring system for S3 requires an in-depth understanding of the strategy across its different priorities, and identifying the tools and measures to synthesize it. HEIs cluster experts from different disciplines (economists, natural and social scientists, etc.) that can contribute to this task by providing information on both general and priority-specific methodologies and measurement approaches, supporting the process of learning by monitoring.

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4 Masana and Fernández-Sirera (2018)
5 (European Commission, 2011)
6 The MOOC is available for free: https://iversity.org/en/courses/monitoring-smart-Specialisation-strategies

These activities can be developed under independent projects, with individual HEIs' staff, or within long-term collaboration schemes, allowing consistent follow-up, such as with established research centres focussed on innovation and regional development.

Box 1: The RIS3CAT (Catalan RIS3) monitoring system: introducing 'learning'

The Catalan Government's department responsible for the Catalan RIS3 (RIS3CAT) jointly with the author of this chapter (representing the HEI role) developed a model to monitor the RIS3CAT[7], switching from previous systems that were mostly accountability-based to a new one in which the concept of 'learning' takes a predominant role. The monitoring system comprises initiatives that allow identifying 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. For instance, the monitoring system includes a new questionnaire addressed to beneficiaries at the end of their projects. Beneficiaries do not only answer questions related to the outputs or outcomes of the project itself, rather they assess the learning opportunities the project has provided as this is considered more relevant, in the long-term, than the project-results themselves. In such way, among other things, it is possible to identify stakeholders' new skills, partnerships and interests.

More information: Masana and Fernández-Sirera, 2017 - RIS3CAT monitoring strategy:http://catalunya2020.gencat.cat/web/.content/00_catalunya2020/Documents/angles/fitxers/MonitoratgeRIS3CATen.pdf

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Cooperation idea 2: Data collection for monitoring

When a monitoring system is designed, it is crucial to assess data accessibility and, if missing, formulate a plan for adequate collection. Indeed, one of the main challenges linked to the design and implementation of S3 monitoring systems is the unavailability of priority-specific regionalised data. As the examples below suggest, HEIs can help in the construction of new or improved databases, through surveys designed and sampled rigorously.

Box 2: The Northern Netherlands Innovation Monitor

In 2015 the Northern Netherlands Innovation Monitor (NNIM) was set up under collaboration between the Northern Netherlands Alliance (responsible for the S3 in Northern-Netherlands) and the University of Groningen. This initiative aims at providing relevant data in addition to the existing one in the Statistics Bureau.

The Innovation Monitor runs an annual survey (with a maximum of 50 questions) that includes thousands of SMEs in the region. Data is analysed by, among other people, a PhD researcher in the field.

Participating firms receive an individual benchmark report, from the data collected. Furthermore, they are also invited to engage in a further level of monitoring by joining the Innovation Monitor expert-panel and policy-review group, following the participative approach promoted under S3.

Reciprocity is a crucial element of the NNIM, which is considered a strategic venture, as

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7 Masana and Fernández-Sirera (2017)

all participants receive value from the process.

More information: https://www.snn.nl/sites/default/files/2018-03/Northern%20Netherlands%20Innovation%20Monitor%20%28English%29%20Small.pdf

Cooperation idea 3: Analysis of data

Scholars are able to design theoretical and empirical tools to analyse data and extract conclusions. These include concepts such as 'cost-benefit analysis' or 'additionality models', where the impact of public policies is measured using statistical and econometric models. It is unusual for public administrations to have the competences to run such activities and HEIs may be able to provide support.

> ### Box 3: The Ostrobothnian Model of Smart Specialisation
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> The University of Vaasa, in collaboration with the Regional Council of Ostrobothnia, 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 some gap indexes to allow an in-depth understanding of the relationships among actors in the innovation system. The gap indexes, in particular, compare the expectations and the actual experiences of a set of relationships. Overall the tool provides insights into the bottlenecks and opportunities within the local triple-helix system. The tool generates information relevant for S3 planning and monitoring. Furthermore, as the data collection and analysis will be repeated, it will provide a longitudinal understanding of connectivity among local actors.
>
> More information: https://www.obotnia.fi/regional-development/smart-specialisation/preliminary-results/

Furthermore, in recent years, the use of open data and big data tools have changed the landscape and provided new opportunities for monitoring and visualisation. Finding the right ways to analyse and extract conclusions from this data requires technical knowledge and specific mechanisms that can be developed in collaboration with HEIs.

> ### Box 4: ICT tool design under SMART_watch project
>
> 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, the Czech Republic, Hungary, Poland, Slovenia, Germany and Italy). Among the activities developed under this project, the FH Jonnaeum – University for Applied Sciences in Austria has designed a tool that will allow S3 monitoring in the participating regions. They are currently gathering data that will be used for analysis purposes, including benchmarking S3 initiatives and a map of smart specialisation markets.
>
> More information: https://www.interreg-central.eu/Content.Node/SMART-watch.html

HEIs as stakeholders in the 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 to share their views

of what success means to them. Through the participation of stakeholders, it is possible to explore ways to acknowledge and harmonise their different perspectives. HEIs engagement in monitoring can involve scientists relevant to given S3 priority areas, or HEI managers that can have an overview and understanding of the institution as a whole. However, HEIs also host organisations – such as science and technology parks, that can provide different types of input to the monitoring process.

A key issue for HEIs when engaging in S3 monitoring is their double role as experts to support the policy and monitoring process and as stakeholders, i.e. beneficiaries of S3-related funding. While the aim of this chapter is not to focus on this second role, it is important to note that for HEIs to meaningfully participate in S3 (and thereby S3 monitoring), they should have a clear understanding of where they fit within the strategy. This is extremely challenging as HEIs are multidisciplinary and multifunctional actors. It could thus be useful for HEIs themselves to map and monitor their capacities to contribute to S3 (i.e. areas of expertise, fund-raising, etc.), in its different priority areas.[8] This could lead to a better understanding of how HEIs can benefit from S3 and support it.

Cooperation idea 4: Engaging HEIs in monitoring expert groups / working groups

HEIs can take part in expert groups, focus groups or working groups supporting the public administration in monitoring and offering multidisciplinary and multi-functional contributions. Such working groups can be general (as in the example of the Basque Country) or priority specific (as in the example of Extremadura). Let's imagine a working group on health industries comprising representatives from the triple or quadruple helix; HEIs could engage in such groups through experts from life sciences, engineering or social sciences, through STP linked to HEIs, as well as to relevant managers.

Box 5: Orkestra and the Euskadi government – an ongoing collaboration in the Basque Country

Orkestra, a research centre within the University of Deusto, has established a long-term collaboration with the Euskadi (Basque Country) government as it has been entrusted to analyse S3 implementation over time.

This includes, among other things, a series of in-depth interviews with stakeholders closely involved with different aspects of the Basque S3 process. The fieldwork is combined with a review of the many related working documents. Orkestra complements such in-depth understanding of the local context with knowledge of the international and policy debate, taking part in EU research projects and initiatives.

Orkestra is part of the Interdepartmental Government Group, which joins the different departments with a stake in S3. As such, the analytical contribution of the research institute regularly feeds directly into the policy decision making process, allowing the government to identify and address emerging challenges.

More information:

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

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8 The chapter on EDP provides relevant insights on how to map HEIs capacities in relation to S3 priority areas.

As part of its monitoring process, Extremadura has organised a set of priority-specific working groups to discuss the results emerging from S3 indicators and receive feedback and suggestions for the future of the strategy. The working groups comprise between 12 and 25 participants and share a common methodology across priorities. The groups are expected to meet twice a year.

The methodology adopted is incremental, with each meeting building on the results of the previous one. Stakeholders are asked to comment on the monitoring results and then come up with suggestions on current or new policy instruments.

HEIs are involved in two ways in these working groups. First, relevant HEIs representatives in each field are present as stakeholders; secondly, each working group is accompanied by a member of Fundecyt (the regional technical office of the S3) and an expert from the University of Extremadura, who provides methodological guidance and analytical support. Together they ensure that the meetings and outcomes are framed rigorously, allowing a good interpretation of the results of the conversation.

More information: http://www.ris3extremadura.es/

Human capital development and monitoring: formal education and professional training

One of the central activities of the HEIs is training, both within the formal education system (i.e. undergraduate and postgraduate programmes) and, increasingly, for professional audiences. When it comes to monitoring, this is relevant for two reasons: on the one hand, it is crucial to monitor the creation of human capital in local HEIs, as it is relevance for S3 implementation; on the other, it is important to understand whether the specific skills for S3 monitoring are being developed and identify ways to make the most of them.

Cooperation idea 5: Monitoring the production of human capital for S3 in HEIs

The capacities and skills of HEIs students (undergraduate, post-graduate or professional) represent a significant asset for S3 implementation, and as such they should be considered in the context of monitoring. The monitoring process should include data on teaching programmes relevant to S3 (e.g. student participation, employability, mobility).

Given the flexible and multidisciplinary nature of S3 priorities, monitoring human capital creation is far from easy. As such, it demands close cooperation, with periodic reviews, between the public administration and HEIs.

Cooperation idea 6: Harnessing postgraduates (and undergraduates) research skills for S3 monitoring

HEIs' study programmes often comprise a research element. A significant number of both undergraduate and postgraduate students will write theses in disciplines relevant to S3. As monitoring demands high-level research and analytical skills, it could be interesting to harness such research projects to support of S3 monitoring. Indeed, undergraduate[9], master or PhD theses could contribute to the design, data-collection and analysis, along

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9 Needless to say, in the case of undergraduate student, the contribution to S3 monitoring would be more limited, and to be understood mainly as a learning experience.

the lines of the *cooperation ideas* discussed in section two above.[10] Incidentally, the afore-mentioned examples of the Ostrobothnian Model of Smart Specialisation and of the Northern Netherlands Innovation Monitor, both involve PhD students.

Cooperation idea 7: Co-designing professional training for S3 monitoring

Professional training is increasingly common and offers important opportunities for upskilling the workforce. HEIs and the public administration could work together to build capacities for S3 monitoring through professional courses, hence providing a truly applied perspective. Such training programmes should focus on the different perspectives of monitoring relevant for S3, including the policy-logic, the choice of indicators, data-analysis and visualisation, and all the other aspects mentioned in this chapter.[11]

HEIs as champions of monitoring

HEIs, as entities working with scientific methods value, *de facto*, the role of evidence in guiding decisions. As such they can have an important championing role for monitoring. Indeed, they can stimulate the debate around monitoring and engage with policy makers and stakeholders, through their intellectual and cultural activities.

Collaboration action 8: Stimulating the intellectual debate on monitoring

The activities to foster the debate on monitoring can include scientific or informative seminars in cooperation with public authorities, as well as publication or other public-outreach activities. These can keep alive the debate on the importance of monitoring as a tool for public accountability, evidence-based decision making and shared learning.

L'Industria - Special Issue on Monitoring (*forthcoming*)

L'Industria is an Italian journal of applied economics and it is devoting one of its volumes to a special issue on monitoring and evaluating research and innovation policy. The special issue aims at stimulating the academic and policy debate, featuring scientists as well as practitioners from public bodies among its authors. The special issue tackles monitoring and evaluating research and innovation policies in a broad way, acknowledging the learning functions of these processes as well as the new approaches in data and methods that are currently available.

More information:

https://www.mulino.it/riviste/a/issn/0019-7416/newsitem/186

HEIs and S3 monitoring: obstacles, recommendations and final remarks

Smart Specialisation demands a monitoring system that enhances learning for all stakeholders. HEIs, with their analytical and reflective abilities, as well as their interdisciplinarity represent an asset in implementing such type of monitoring.

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10 The instruments of "Industrial PhD programmes" may be relevant for this type of activity. Whilst it is usually understood to be exclusively for technology-based research in private firms, there exist numerous examples in other fields of activity, in cooperation with public administrations as well.

11 Undergraduate and post-graduate programmes, especially covering public policy, political sciences and economics, often include training on policy monitoring and evaluation (and as such, should be mapped as suggested in collaboration action 5). However, at this level, there is typically less scope for the public administration to co-design the curricula.

Whilst the main aim of the chapter is to provide guidance to public administrations willing to engage HEIs in their S3 monitoring process, it is also important to reflect on the obstacles and incentives that HEIs may have in taking part in such activities. It is common for HEIs to include territorial engagement as part of their mission: support to S3 monitoring could fall in this category. While HEIs have a stake in S3, one must be reminded that the incentives for HEIs to engage in S3 monitoring are limited. Academics participating to S3 monitoring face opportunity costs: devoting time to it means giving up time for other activities, especially research and teaching, which are crucial for their career progression (see Chapter Three of this Handbook). Finally, it is also relevant to have in mind that HEIs usually have constrained knowledge of the whole innovation ecosystem, hence, they should not be considered a sole collaborator for monitoring. More in general, any involvement of HEIs in S3 monitoring should be based on a good understanding of their profiles and capacities, as not all the institutions will possess the relevant knowledge.

The chapter has presented a set of suggestions and examples to engage HEIs in the S3 monitoring process. These take into account the different competences that HEIs provide, including analytical, research and teaching skills, as well as their ability to connect to territorial actors.

Needless to say, for HEIs and regional/national administration to find sustainable avenues of collaboration, it is necessary to build a common language, a common understanding of the policy process and of the respective responsibilities and incentives.

While the examples in this chapter identify several ideas for cooperation in monitoring, it is important to acknowledge that, as HEIs and regions are very heterogeneous, there is no "one-size-fits-all" model. Each HEI and region should explore whether there are mutually interesting avenues to work together, taking into account that the process of learning by monitoring yields its results over time and requires experimentation from all sides.

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Chapter Eight - Advice for regional authorities in working with Higher Education Institutions

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This handbook has tried to provide some guidance for regional as well as national authorities who would like to work more closely with HEIs in the process of smart specialisation. In addition, HEIs themselves may also learn about how to better engage with this ambitious EU wide agenda. Each reader should interpret this advice in their own context, because as we have repeatedly underlined, there is great diversity among HE systems and their governance. It may be used both as a form of self-assessment and as a tool box for improving the design and implementation of S3. In this final chapter we summarise and elaborate on the main messages from the six different themes of the handbook, as illustrated in the Figure below.

Figure 1: The six HESS themes

1. Understand the higher education system

S3 managers that wish to work more closely with HEIs should frame their work on an in-depth understanding of how higher education in their country or region is funded and regulated. This must embrace tertiary education in the round, since important knowledge and human capital may be provided by institutions that do not have the higher degree awarding powers that distinguish the classic university – such as universities of applied sciences, vocational colleges and private higher education providers. Each part of the tertiary education system may be funded and regulated differently, for example in terms of the degree of institutional autonomy, and this can have a bearing on the priority attached to the delivery of regional benefits. Where there are several and different HEIs in a region, and no direct local powers over them, it may be appropriate to use regional funds to incentivise cooperation. This may require research based discovery, the diffusion of established knowledge, organisational and skills development. In short, regional authorities may need to move towards the bottom-up creation of a regional tertiary education system.

2. Build relationships with people as well as institutions

Engagement with HEIs cannot 'stop at the front door', especially when it comes to traditional universities that undertake research as well as teaching – and mobilising both to underpin regional innovation. While institutional leaders, such as rectors and vice-rectors, may engage with regional authorities in dialogue around S3, it may be appropriate to find ways to also reach individual academics. Indeed, they may be collaborating with regional businesses, public authorities and civil society organisations in their teaching and research below the radar screens of institutional. In seeking to engage HEIs corporately in the design and delivery of S3, regional authorities need to develop an understanding of how each institution in its area is led and managed and find ways to align institutional, individual and regional incentives, whilst identifying both institutional and individual strengths. Key questions relate to: How teaching and research is planned, resourced and managed by whom and for what purpose? How is academic staff incentivised and rewarded for collaborative work with local businesses and the community and how does this affect career progression? What is the role of work-based learning and supporting student enterprise in teaching; Answers to these questions may vary significantly between HEIs in the region, not least between traditional universities and universities of applied sciences. While all of these management challenges apply generically to third mission work, they are particularly pertinent when it comes to the institution playing an active role in regional smart specialisation.

3. Allow HEIs to support the Entrepreneurial Discovery process

A continual Entrepreneurial Discovery Process (EDP) requires knowledge that might be widely dispersed across an HEI; it means that the institution must have the capacity to draw knowledge together quickly but not in a command and control fashion, or through bureaucratic audit mechanisms. While regional authorities may provide incentives to the HEI to engage in what might nominally be labelled as entrepreneurial discovery, care has to be taken that the knowledge supply interests of the academy do not dominate over the demand side of what must be an iterative process. The risk of this can be reduced by the region supporting a specialised intermediary organisation to undertake the facilitation task. Again care needs to be taken in shaping the business model of the intermediary to ensure that it remains a conduit for knowledge exchange and not a barrier or even competitor to the HEIs.

4. Closely involve HEIs in the governance of S3

Responses to the challenges of working with HEIs can be found by closely involving them in the governance of S3**.** Chapter four of this handbook defines governance as 'a form of self-organisation based on negotiations, networking and efforts to reach mutual understanding and shared goals'. This could take the form of *co-ordinated* actions between HEIs and various public organisation or *experimental governance*. The latter integrates entrepreneurs into a continuous learning process in which key organisations in the public sector, including HEIs, recognise their limited knowledge of the implementation context and define policy objectives as an iterative process. Some of that knowledge may also reside with citizens as potential users of new products and services and with a strong stake in the future of their place based communities, most notably their city rather than a heterogeneous region. HEIs are quintessentially urban institutions and can become a hub for a region wide entrepreneurial discovery process by

using their convening power to bring together city based public authorities, businesses and citizens in so-called 'quadruple helix' partnerships.

5. Design locally tailored funding programmes to incentivise HEIs

Funding instruments are the main means of turning strategic objectives into reality. However, there is no 'one size fits all' formula. Firstly, incentives must resonate with the core mission of each institution in the region, whether a research intensive traditional university or a teaching orientated university of applied science. Secondly, the nature and scope of the funding programme will depend on the existing levels of knowledge: some regions will be more advanced in the identification of specialisations and more focused investments will be appropriate; where this is absent more exploratory projects could be more beneficial. Thirdly, the type of programme may be competitive or could take the form of a compact with each institution to deliver key regional smart specialisation outcomes (not just outputs) in return for funding. This may be preferred to a process of competitive bidding for individual projects that might not aggregate to deliver long term change. For example, this could include permitting businesses to help shape the curriculum and support work based learning; new HR processes that incentivises and rewards staff to work with local companies and procurement of goods and services that can support key enterprises in regional smart specialisation. Finally, depending on the objectives such incentives may be designed at regional, national or EU levels. All can contribute to the delivery of an S3 but to be most effective they will be implemented in a synergetic way. Different elements of a project can be funded by various sources but crucially there is a strong regional coordinator to raise awareness of opportunities for HEIs and orchestrate a strategic approach.

6. Make the most of the technical skills of academics for S3 monitoring

Monitoring the implementation of S3 is an extremely challenging task and some regional authorities, especially in less developed areas, may lack the necessary technical skills and / or capacity. HEIs may be able to help by supporting data-collection, data analysis and by contributing to the participatory learning process that S3 monitoring should enhance. In addition, HEIs can support capacity building through training for monitoring. From a research perspective monitoring can also provide interesting data for analytical work, creating a win – win situation for the region and the HEI.

To conclude, what is the overall approach that regional authorities could use in working with HEIs? As suggested in the introduction, regional authorities could seek to work with the whole tertiary education sector to address long term societal challenges that have both a local and global dimension and where there are opportunities to specialise in particular innovative niches. This will be welcomed by researchers wishing to participate in science excellence driven European programmes while combining it with their social responsibility to the place where they live and work and behave as active citizens. From a regional authority perspective it means using regional funds to anchor the global knowledge of HEIs and the skills they provide citizens and businesses to develop the communities for which they are responsible, delivering this through smart specialisation strategies that support inclusive and sustainable growth.

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