

UASiMAP



UASiMAP
**Literature Review On The
Regional Engagement
of Universities
of Applied Sciences**

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1. Introduction

Context of the literature review

The UASiMAP project (Mapping regional engagement of Universities of Applied Sciences) is co-funded by the Erasmus+ programme of the European Union and will be implemented in the period 2019-2022.

The main aim of the project is to develop a self-reflection tool that will measure the local engagement of universities of applied sciences (UAS) and support the development of their further strategies.

Other related aims are:

- to map and further support the regional engagement activities of European professional higher education (PHE) institutions, in particular, UAS
- to promote and communicate higher education institutions (HEIs)' contribution to society and regional community, based on the experience and insights of key stakeholders from across the whole European Union (EU)
- to collect good practices of successful UAS engagement at the local level, including the relevant literature review.

Last but not least, the project intends to benefit from the experience and conclusions of other similar initiatives and projects' outcomes and the experience and insights of key stakeholders from across the whole EU.

The project partners are Augentes, Italy (a leading company in the promotion of research and development), VLHORA (Flemish Council of Universities of Applied Sciences and Arts), Hungarian Rectors' Conference, THEA, Ireland (Technological Higher Education Association), CCISP (The Portuguese Polytechnics Coordinating Council), TTK UAS, Estonia (TTK University of Applied Sciences) and CHES, Czech Republic (Centre for Higher Education Studies); the project leader is EURASHE (The European Association of Institutions in Higher Education). EURASHE represents UASs and university colleges; other members of EURASHE are national and sectorial associations of higher education institutions, and other individual institutions, including universities. Its mission is to strengthen the impact of innovative, high-quality professional higher education and related user-oriented research in Europe by representing professional HEIs and facilitating their multi-stakeholder cooperation and dialogue.

EURASHE recommends increasing the cooperation between UAS and regions in Europe (2019, p.3): "UAS focus on support and social and economic development of the community within their region building upon their strong links and partnership with regional, private, public and non-governmental organisations." To facilitate the understanding of the current state of the UAS regional collaboration and to enhance it in the future, EURASHE has undertaken several studies and led/participated in several important projects focused on the above-mentioned theme over the last several years. Some recently finalised (or still running) projects, co-funded from the EU Erasmus+ programme, include PROCSEE (Strengthening Professional Higher Education in Central and South-Eastern Europe), BUILDPHE (Building Professional Higher Education Capacity in Europe), RECAPHE (Enhancing Staff Research and Innovation Capacity in Professional Higher Education).

This literature review focuses on the selected set of relevant resources including articles, reports and projects results which highlight indicators about HEIs' regional engagement or provide a basis for developing such indicators. This desk research phase drew on the existing knowledge of the project team and a search of both published and grey literature using relevant keywords. We have focused our investigation on over 20 sources, based on a quick scan, which met these expectations. The literature review should support the creation of a set of indicators for the self-assessment of UAS regional cooperation in 7 categories, which were created within the UASiMAP project (categories: the active role of UAS in regional strategy development and implementation, regional aspects of teaching and learning, UAS capacity for the region, research and innovation, social innovation, lifelong learning, other (means topics which do not fit the previous six categories)).

Therefore, the knowledge obtained from the literature is structured according to these categories. For each category, the relevant findings are briefly described and a selected example of good practice is given. Then the review focuses primarily on the qualitative and quantitative indicators applicable in the category. Each category concludes with a partial summary of the main issues for consideration.

Note for reading literature review: It is important to clarify the differences between UAS and VET (vocational education and training) institutions. European UAS are part of the tertiary education system, they are part of the Bologna process and they cover education from level 5 to level 8 of the European Qualification Framework (EQF), even if some of them focus primarily on professional bachelor degree programmes. In some literature sources, the UAS is considered as part of Higher VET (HVET) (Ulicna, Messer & Auzinger, 2016). Therefore, when using literary sources, it is necessary to distinguish European VET institutions that are part of the Copenhagen process and they cover mainly education from level 2 to level 4 of the EQF.

1.1 Understanding regional engagement in higher education and definition of regional engagement of UAS

The regional engagement of higher education institutions (HEIs)¹ has been an important theme that has been researched by a large number of scientists with the results published in a wide range of literature. We can start with the OECD programme on higher education in cities and regions, which took a broad and holistic view on HEIs' regional engagement (OECD, 2007). Goddard and Puukka investigated the partnerships of regions and HEIs established with shared interests and their paper concludes with suggestions "as to how the capacity for joint working between HEIs and regions can be enhanced through generic changes in policy and practice at the institutional, regional and national levels" (Goddard & Puukka, 2008).

The level of interactions with regional stakeholders can vary from strong ties to nearly invisible ones. However, conscious interaction with regional stakeholders should be a part of UAS' regional engagement and even weaker ties should also be reflected and visualized. Last but not least, we would like to emphasize the entrepreneurial dimension of regional engagement of UAS. According to FFE-YE (2012, p. 11), "Entrepreneurship is when you act upon opportu-

¹ We use term HEI when we speak generally about higher education institution and UAS when we speak specifically about universitite of applied science.

nities and ideas and transform them into value for others. The value that is created can be financial, cultural, or social". This is the way that UAS can contribute to regional development.

Several authors emphasize the importance of the role of the HEI in regional development: "The role of HEIs is pivotal in regional development and innovation and it emphasises not only their role in knowledge production but also in the knowledge dissemination and application through cooperation with regional partners, and, importantly, the most important 'product' of HEIs – the students (graduates), who can provide valuable human capital for the regions!" (Edwards & Marinelli, 2018, p. 32). The impact of the HEIS on regional development varies, depending on the specific disciplines and knowledge bases that it features. (Bonaccorsi, Biancardi, Sánchez-Barrioluengo & Biagi, 2019)

Much of the research on HEIs' regional role has focused on research-intensive universities. However, some authors emphasize the need for a more prominent role for professional higher education (PHE) in the development of regions (e.g. Foray et al., 2012; Hazelkorn & Edwards, 2018), and also advocate the involvement of the UAS in the development of the regional strategies (Foray et al., 2012, etc.).

To define regional engagement of UAS, the definition of community engagement developed in TEFCE² project (Towards a European Framework for Community Engagement in Higher Education) was a useful inspiration. The use of this with only one small change led to the definition of regional engagement as "a process whereby UAS engage with regional stakeholders to undertake joint activities that can be mutually beneficial even if each side benefits in a different way". (Benneworth et al., 2018, p. 28-29, UAS input by authors). However, this definition is relatively wide. We see it as important to combine the regional engagement of UAS with the term "engaged scholarship" (THEA, 2017), which aims to link teaching and research closer together and to create partnerships with (regional) business, public bodies, people/citizens and international organizations in a way which is planned and deliberately sought.

Joint work on the UASiMAP project, inspiration from the literature and the experience of EURASHE led to a new version of the definition of UAS' regional engagement:

Regional engagement constitutes an important, integral part of the mission of institutions of professional higher education³ through which they serve people and communities within their respective region. This dimension of the mission is fulfilled through systemic activities and processes engaging relevant regional stakeholders in order to:

- *provide capacity for regional strategy development and implementation;*
- *develop talents, competencies and skills reflecting regional needs;*
- *promote regional development through user-inspired research and innovation;*
- *enhance social, civic and cultural activities of the region's community.*

While the identification of the region, its key actors and stakeholders may be flexible to respect the local context, the values and characteristics of professional higher education propose that the world of work, students and other potential learners, regional bodies and authorities and civic society organisations are expected to be among the key partners and stakeholders. The systemic approach to the regional engagement of professional higher education institutions is supported by their strategies, policies, processes and partnerships and results in a created

¹ www.tefce.eu

² Universities of applied sciences represent the most visible institutions of professional higher education (PHE) in many binary higher education systems; however, the range of these institutions spreads much wider including various parts of regional or specialised universities, colleges of higher education and other providers respecting the values and characteristics of professional higher education.

value within their ecosystem. Higher education institutions' capacity to address regional issues by bringing together a variety of actors and expertise from local, regional, national and international levels represents an important, specific asset in such efforts (EURASHE, 2013).

1.2 General criteria for the self-reflection framework/tools and challenges

The self-reflection should help UAS

- to reflect and clearly describe strengths and weaknesses of its own different activities related to the engagement in regional development, to improve found shortcoming and to facilitate and develop further the effective relations and joint work with regional actors;
- to make visible the impact of successful activities on regional development and innovations and to underline their important role in the higher education ecosystem;
- to serve as the important (mostly obligatory) background for the evaluation by external evaluation/accreditation bodies or international agencies. (We can quote ENQA and its evaluation of national agencies, as the requirements (standards) for self-evaluation of mentioned agencies is well applicable for self-evaluation of HEIs (ENQA, 2016)).

It is important to note the different terminology used for various tools. We speak about the self-reflection tool (in UASiMAP and similarly in some of the other below-mentioned literature sources), we can find also the term self-evaluation (for example above mentioned ENQA) or self-assessment used by HEInnovate, Andres Furco's Rubric (see below).

The self-evaluation tool can be

- **questionnaire-based**: for example, Carnegie Foundation Community Engagement Classification, which uses closed questions in combination with qualitative responses as explained in more detail below;
- **standard-based**: enabling the HEI to assess whether its practices are in line with a standard which is defined as a statement. Examples can be taken from the Dutch accreditation of study programmes, which starts with work on a self-evaluation report. The self-evaluation report should present how (to what extent) the individual standards are met (NVAO (Dutch-Flemish Accreditation Organisation), 2018);
- **progress-based**: enabling the HEI to assess its level of development in specific areas according to predefined requirements and identify the steps to improve (for example self-evaluation reports of Dutch HEIs in the framework of the institutional audit (NVAO, 2018));
- **indicator-based**: using qualitative, quantitative or mixed indicators, as described below using several examples from literature.

The self-reflection tools usually / frequently use indicators and, thus, the literature review focuses primarily on indicators. The indicator is a piece of information that allows for measurement (or judgement) of a process or a change. The indicator should be connected with evidence, which proves this indicator. As mentioned above, we can divide indicators into two basic categories: a) quantitative and b) qualitative indicators. The quantitative indicators are expressed as numbers, such as units, rates of change, ratios or proportions. Their strengths are that they present a macro-view on the situation and the process of change. On the other hand, they usually do not provide in-depth information about the change. Qualitative indicators

draw deeper and provide a micro view on the process of change, but they cannot be easily compared. They are often used as a basement for quantitative scale or rating. (Simister, 2015).

A tool for measuring the regional impact of UAS can be based on a mix of qualitative and quantitative indicators. In this respect, Andrew Furco's Rubric for the Institutionalisation of service-learning in HEIs⁴ provides a particularly useful approach. The Furco Rubric is a self-assessment tool for the institutionalization of service-learning in higher education. It provides not only a qualitative assessment but also a number score for each component, which allows measurement of changes over time at the institutional level as well as for inter-institutional benchmarking (Furco & Miller, 2009 in Benneworth et al., 2018). However, the effective use of the numerical scale requires good descriptions, and without those its use is problematic.

HEInnovate⁵ is a tool for self-assessment of HEIs in the area of entrepreneurial activities. It is structured into dimensions such as leadership, staffing and links with business, and offers a scale from 1- to 5 with rather general examples to illustrate scores for a given indicator. It focuses on qualitative aspects, but nevertheless, it uses this 1 - 5 scale to quantify them. It causes a question if the tool is based on qualitative or quantitative indicators.

Another inspirational tool can be the Carnegie Foundation Community Engagement Classification, which provides a solid model not only for enhancing the community engagement of HEIs but also for promoting and measuring the regional engagement of UAS. This model consists of a questionnaire-based self-assessment and a review process by the Carnegie Foundation. The questionnaire comprises 63 core questions, combining closed questions (questions with 'yes/no' answers), quantitative data collection and multiple-choice options, and qualitative responses to support the answers to the closed questions. The submitted self-assessments are reviewed by a National Review Panel consisting of leading scholars in community engagement, who assess which institutions qualify to receive the quality label. This tool has a high reputation. However, using closed questions is less valuable than the Furco Rubric which provides a more nuanced view of different levels of the development of different aspects of the engagement. The lengths and the complexity of the tool may also be problematic. There are up to 80 boxes providing space to give qualitative responses (up to 500 words). (Benneworth et al., 2018)

The review of the literature shows that developing robust self-evaluation tools and identifying indicators for the HEIs' engagement role is a challenging task. The tools and indicators should cover a wide range of activities. On the other hand, they should not be too detailed if HEIs are to be motivated to use them. It is therefore not surprising that developing simple measures and headline indicators, instead of those sometimes leading to highly complex systems, remains a challenge in many higher education systems and institutions. For instance in Sweden, "*a first effort to develop a comprehensive measurement framework led to the proposal of around 200 indicators that lacked any legitimacy in the sector because of the burden it imposed.*" (Benneworth et al., 2018, p. 32)

We agree with the results from the TEFCE project that the tool should be more formative than summative, meaning that it is better to inform and improve the process than to reach the final

⁴ Furco Rubric is a self-assessment tool focused primary on service learning and revised version on community engagement. You can find an older version in Furco (2002) or a more detailed description in Benneworth et al. (2018).

⁵ <https://heinnovate.eu/en/about>

judgement. The problem with the current tools that measure the engagement of HEIs is that they focus on the self-perception of the HEIs, rather than on the assessment by their external stakeholders (Benneworth *et al.*, 2018, p. 113). To overcome this limitation, the UAS need to ask themselves how they can develop a tool that can adequately capture the views of both internal and external stakeholders.

We underline the importance of developing a tool that can reflect the broad regional engagement of UAS, not only the economic or technological factors but also the social, environmental and cultural aspects. The tool should also adequately capture the contribution of the arts, humanities and social sciences to regional development and innovation (Goddard & Kempton, 2011, p. 10).

The mere presence of an HEI in a region brings many positive benefits and has generated a range of econometric studies. Using a spatial econometric approach, Bonaccorsi *et al.* (2019) suggest that the presence of a university generates a strong positive effect on labour productivity in the surrounding area: an increase of 10% in human capital in a region has an average direct impact of 3.0% in the neighbouring regions. They conclude that the spatial distribution of HEIs, meaning the creation of university sites or branches at dispersed geographical locations, increases the productivity and output per worker. The presence of HEIs has a positive effect on the wages of workers with a lower level of education following a strong spill-over effect. Human capital externalities arise because workers learn from each other, and they learn more from more highly-skilled individuals. The role of UAS is particularly important as Bonaccorsi *et al.* (2019) emphasize, along with the “coalition of modern universities”⁶.

⁶ Coalition of Modern Universities (CMU) are former English Polytechnics that received the status of universities after the Thatcher reform, they are not research-intensive and are mostly oriented towards the local economy. From the Irish point of view, however, there is some risk that the reform could be perceived primarily as a renaming exercise, whereas the development of technological universities in Ireland is conceived as more complex and strategically significant.

2. Regional engagement of UAS

Based on the project team’s discussion and consultation with experts, we have defined 7 categories that we used for the classification of indicators or evidence bases for indicators. These categories reflect existing literature and studies dealing with the role of HEIs in regional development (e.g JRC, 2013; Farnell, 2020; Benneworth et al., 2018). We started with the following **triple helix** framework in which “universities are crucial actors in regional development, driving innovation via systematic cooperation with government and industry in the production, transfer and application of knowledge, with an emphasis on technology“ (Farnell 2020, 13). However, we identified a missing social/civil society dimension and we decide to build our categorization on a **quadruple helix** (business, research/education, public sector, civil society/users) (JRC, 2013). We present the suggested categories and their (potential) links to the main actors of a quadruple helix in Table 1.

Table 1. The initial framework for research

	Categories	Main actors
1.	The active role of UAS in regional strategies	Public sector (e.g. regional government) + Civil society/users
2.	Regional aspects of teaching and learning (formal education)	Civil society/users + Education
3.	UAS capacity for the region (facilities, cultural and sport activities)	Civil society/users + Public sector
4.	Research, development, innovation and new business development for the region (for/with companies)	Research + Business
5.	Social and cultural innovation	Civil society/users
6.	Lifelong learning (activities)	Education + Civil society/users
7.	Other (the issues which do not fit the previous six categories)	(as open space for additional missing categories)

Each category starts with an overview of activities covered by this category and the significance of these activities for UAS. We also underline specifically the UAS in comparison with research-intensive universities. We also list some challenges facing UAS in these areas. We end each overview with one example of good practice which gives readers a better idea of how the UAS role in this dimension is useful for regional development. Finally, we present possible indicators or evidence for them, and we then summarize each category.

2.1 Active role in regional strategies

EURASHE (2019) recommends that the UAS should take an active role in the design and implementation of regional strategies through a proactive and holistic approach to the regional knowledge transformation cycle, and by supporting more flexible and open joined-up governance of regional development in collaboration with the regional governments, chambers of commerce, employers' associations, academic and professional HEIs and other relevant actors.

Taking an active role in regional cooperation with other stakeholders would require that the UAS strategy is adequately aligned with the regional strategies (Foray et al., 2012) and also addresses the actors in the quadruple helix framework – business, research, public sector and civil society/users (JRC, 2013). This alignment brings mutual benefits to the regional actors. For instance, Hazelkorn and Edwards (2019) stress that the formation of regional innovation clusters comprising education and research institutions can help generate critical mass and nurture social ties with other parts of the public sector and with business and the community to maximise the use of available resources.

UAS tend to have the strongest effect on the local labour market, and also a strong local orientation and mission (Faggian & McCann, 2009). Literature review shows that the inclusion of UAS in the regional development committees, councils and working groups is key to the active long term role in the region. Goddard & Puukka (2008) stress the need for inclusiveness on both sides: UAS need to ensure that the key regional actors in business, industry, public sector etc. are invited to the UAS bodies to ensure a direct impact on the UAS education and training provision, RDI and service.

The UAS can participate in regional development through participating in bodies/initiatives focused on regional development and innovation. For example, Regional Innovation Strategies (RI3S), the Regional Competitiveness Councils or equivalent organisations, which provide an opportunity to contribute to the development of innovations and facilitation of the entry of new investors into the region; it can also enable the participation of faculty representatives in the design and implementation of the Regional Innovation Strategy and cooperation with the Regional chamber of commerce (in the field of technology and management) and other key stakeholders. (Šebková & Roskovec, 2017).

In practice, however, there is an absence of UAS in discussions, decisions and implementation of RIS3⁷ strategies, given a lack of political and institutional leadership (Hazelkorn & Edwards, 2019). Currently, there is little evidence of systematical integration of VET institutions and UAS into Smart Specialisation Strategies and related governance structures. HEIs' involvement is often limited to the top leadership/senior manager level. Regional authorities have also found it difficult to engage HEIs in the design and implementation of RIS3 in terms of human capital contribution and skills development, while research-intensive universities have often used such governance structures to lobby for increased spending on research in their particular specialisation (Kroll, 2016; Edwards, Marinelli, Arregui-Pabollet & Kempton, 2017).

⁷ Research and Innovation Strategy for Smart Specialisation

Good practice

This example shows how regional strategy can use UAS for regional development. The Basque Country (ES) **Smart Specialisation Strategy (3S)** is aligned with the emphasis on UAS Excellence, with an integrated approach to training, applied innovation and active entrepreneurship. The 3S strategy was formally set out in the Science, Technology and Innovation Plan 2020 published at the end of 2014⁸. The strategy, which links firmly aligned with RIS3, puts sustainable human development at the centre and emphasizes that Internationalisation is a transversal component. Accordingly, VET is positioned at the core of the Technological Innovation System in the Basque Country. The objective is to help guide the applied innovation, bringing together 19 centres in 4 hubs organised around priorities: (i) advanced manufacturing, (ii) digital and connected factory; (iii) energies, and (iv) biosciences and biotechnologies. There is strong cooperation between VET/UAS and SMEs in the provision of services, the aim of which is to provide high-level specialist support going beyond the simple provision of training. (Hazelkorn & Edwards, 2019; Puukka et al., 2013). As an example of UAS, we can mention private Mondragon University which, based on the 3S, focuses on a study programme in bioengineering. Mondragon University members of staff also actively participate in the development of 3S, the university strategy is aligned with 3S. Mondragon University also encourages PhD students to research 3S topics. strategy, which links firmly aligned with RIS3, puts sustainable human development at the centre and emphasizes that Internationalisation is a transversal component. Accordingly, VET is positioned at the core of the Technological Innovation System in the Basque Country. The objective is to help guide the applied innovation, bringing together 19 centres in 4 hubs organised around priorities: (i) advanced manufacturing, (ii) digital and connected factory; (iii) energies, and (iv) biosciences and biotechnologies. There is strong cooperation between VET/UAS and SMEs in the provision of services, the aim of which is to provide high-level specialist support going beyond the simple provision of training. (Hazelkorn & Edwards, 2019; Puukka et al., 2013). As an example of UAS, we can mention private Mondragon University which, based on the 3S, focuses on a study programme in bioengineering. Mondragon University members of staff also actively participate in the development of 3S, the university strategy is aligned with 3S. Mondragon University also encourages PhD students to research 3S topics.

Indicators for the UAS role in regional strategies

Quantitative indicators

We found only an indirect indicator from Bonaccorsi et al. (2019) who propose to use data about investment dynamic in the region. It would also be possible to use data about employability in the region (Hazelkorn & Edwards, 2019).

Qualitative indicators

We would like to note that many qualitative indicators could be quantified through scale visualization.

These indicators focus on different ways that UAS/HEI can engage in the strategic development of a region.

⁸ <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/policy-document/science-technology-and-innovation-plan-pcti-euskadi-2020>

Edwards and Marinelli (2018) propose these indicators:

1. Cooperation between government, HEI and business (integrated response to regional needs);
2. Existing networks and collaboration patterns in competitive projects and co-publications;
3. Participation in EU projects supporting industrial leadership and societal challenges;
4. Strategic plans to emphasise the 3rd mission;
5. Well-balanced representation of stakeholders in governance structures including external stakeholders;
6. Work with regional authorities and co-operation with external partners;
7. HEI has a system of various criteria that go beyond publication outputs: more visibility to teaching, work in university management or decision-making bodies, committee membership, work with regional authorities, active co-operation with external partners and knowledge transfer;
8. Strategic plans to emphasise the local impact of education;
9. Identification and engagement of HE actors.

Foray et al. (2012) mention: University strategic advice and experts to work directly on regional development priorities.

JRC (2013) suggests using: Evidence of the innovation users/ boundary spanners,⁹ other than of the academic world, public authorities, and the business community - obtaining a quadruple helix.

Bonnacorsi et al. (2019) propose to use: Information on how university curricula and research development directions match the regional strategy/ profile.

Šebková and Roskovec (2017) mention:

1. Membership (faculty) of the Regional Competitiveness Council, which provides an opportunity to participate in the preparation of innovations and the entry of new investors into the region;
2. Participation of faculty representatives in work on the Regional Innovation Strategy;
3. Cooperation with hospitals and/or spa facilities in the field of health studies;
4. Cooperation with the Regional Chamber of Commerce (in the field of technology and management).

Goddard and Puukka (2008) write about:

1. Establishment of a regional steering committee composed of HEI(s) and a wide range of regional stakeholders, input to regional strategy development;
2. Adequate rewarding of staff mobilising in support of regional agenda;
3. Ensuring that the HEIs' roles in the region are embedded in the regional strategy.

HEInnovate is a free self-assessment tool for all types of HEI. It allows the individual user to assess her/his institution using several statements related to its entrepreneurial activities, including leadership, staffing and links with business. HEInnovate includes this indicator:

⁹ Boundary spanning is a term to describe individuals within an innovation system who have, or adopt, the role of linking the organization's internal networks with external sources of information (Tushman, 1977)

The HEI is committed to collaboration and knowledge exchange with industry, the public sector and society. Knowledge exchange through collaboration and partnerships is an important component of any innovative HEI. It provides the opportunity to advance organisational innovation, teaching and research while creating value for society.

HEInnovate¹⁰ proposes to evaluate HEI situation and score each aspect on a scale (from 1 to 5), for example:

- Ensure knowledge exchange and collaboration is a high priority at the senior level and that implementation is in line with the institution's entrepreneurial agenda;
- Establish structures to exploit knowledge exchange and collaboration opportunities, and encourage staff to engage in such activities;
- Include support mechanisms for coordinating and sharing relationships across the HEI.

HEInnovate proposes definitions/examples of best practice to prompt users' reflections about their HE institution's strategy and approach to its implementation, and to facilitate further improvements.

Partial summary

We estimate that the influence of UAS on regional employment is hard to measure. Only some countries have tracking of graduates regional migration (Beadle et al., 2020). The qualitative indicators should focus on the connection between UAS and regional strategy and the participation of UAS in the regional development process.

2.2 Regional aspects of teaching and learning

Embedding regional aspects in teaching and learning is important as it brings benefits to both the UAS and the respective communities/regions. UAS teaching and learning contributes to the development of the community through occupational training, "engaged" teaching courses for students (e.g. service-learning), internships, work-integrated/work-based learning and co-creation of the new curriculum with community/regional representatives including people from business and NGOs (Benneworth et al., 2018; Goddard & Puukka, 2008; Šebková & Roskovec, 2017). UAS can also stimulate the entrepreneurial spirit of their staff and students (Goddard & Puukka, 2008). UAS should engage students in the creation of start-ups and in projects where students work with external stakeholders (EU, 2017). UAS also need to pay attention to the number and quality of courses provided by online or blended learning which are offered to the regional students (Šebková & Roskovec, 2017).

Several authors emphasize the value of aligning the HEIs' education and training provision with the regional needs and specificities and of developing strong regional partnerships. For instance, Hazelkorn and Edwards (2019) recommend the inclusion of the principles of smart specialisation in the universities' teaching and learning through a strategic place-based approach to curriculum design, which means adding comparative value to the regional economy by developing programmes that build on local expertise, products and needs. This

¹⁰ HEInnovate focuses on qualitative aspects, however it uses scales to quantify them. Therefore, it could be categorized as quantitative or qualitative.

includes broadening partnerships with local businesses, service providers and industry associations; and establishing a network of education institutions. The role of UAS in building sustainable regional innovation ecosystems also means enabling the development of more equitable communities and focussing higher education curricula on transversal competencies such as creativity, entrepreneurship and initiative to enable young people to realise their innovative potential (Hazelkorn & Edwards, 2019; Probst, Pedersen & Wenger, 2019).

The research literature also stresses the growing importance of several fields and disciplines in UAS education and training provision in line with challenges and opportunities arising from the region as well as focusing on gender issues. According to Bonnacorsi et al. (2019), technological and managerial disciplines and engineering have the biggest impact on regional economies. Training in ICT and digital technology programmes at the regional UAS are increasingly important given the rapid technological progress, the regional smart specialisation, changes in the labour market and the need to skill and reskill the population (EU, 2018). Probst et al. (2019) suggest that UAS should develop female talents, and encourage and support the development of high-tech T-shaped skills¹¹.

Universities, including UAS, are increasingly exploring innovative ways to gain income in collaboration with companies and regional or municipal governments and making this part of territorial skills strategies. When skills training initiatives are co-financed by companies and/or governments, special attention should be paid to preserving academic freedom and the continuation of fundamental research (Probst et al., 2019).

Good practice

As an example of good practice, we can highlight the Poliempreende project¹² - a contest of ideas and projects of entrepreneurial vocation, in which CCISP (Portuguese Polytechnics Coordinating Council) participate. The objective is to stimulate entrepreneurship and provide professional opportunities through the creation of their jobs. (Pires & Justino, 2020). Poliempreende highlights and explains the polytechnic identity. It aims to stimulate the entrepreneurial culture in each member of the academic community, developing specific training, publications on the topic, workshops for the development of ideas, contests for the sharing and dissemination of ideas and projects. (Pires & Justino, 2020)

Indicators related to teaching and learning

Quantitative indicators

We show interesting examples of indicators that could be connected with the regional engagement of UAS.

Foray et al. (2012) mention: Numbers of programmes /graduates from entrepreneurial courses.

Bonaccorsi et al. (2019) mention these indicators:

1. The numbers of graduates correlate with the growth of labour productivity in the region.
2. Productivity and output per worker.

¹¹ T-Shape skill means developing deep expertise in one discipline early in their career and supplement this with development of soft competencies.

¹² <https://www.igi-global.com/chapter/poliempreende-project/224131>

3. Dynamics of wages of workers with a lower level of education in the region.
4. Data on:
 - a. vertical mismatch (level of education or skills is lower or higher than the requirements of a job position);
 - b. horizontal mismatch (level of education or skills adequate, but not in the field required for employment);
 - c. over or under qualification (a person has a higher/lower level of qualification than required for a job position);
 - d. over or under skilling (a situation where a person is unable to fully use their skills and abilities in the current job position or lacks the necessary skills and abilities for performing).
5. Quantitative data of numbers of UAS graduates who remain in the region compared to graduates from research-intensive universities;
6. Tertiary education in Business is positively associated with higher performance in terms of growth of turnover and employment but only at a close distance (within 10 km) or a long-distance (between 51 and 100 km);
7. Graduates in Natural Sciences have a positive impact on turnover and employment at closer distances (within 10 and 11-20), and a positive impact is confirmed for employment only within 10 km;
8. As for employment, there is some evidence of a positive correlation with the number of graduates in Business and Natural Sciences, but only at a low distance;
9. The growth in intangible assets depends positively on graduates in Technology in panel A and negatively on graduates in Business in panel B;
10. The number of citations Technology is associated with the growth of total assets across all but the closest distances. It is also associated positively with the growth of employment but only in the 51-100 km distance.

Goddard and Puukka (2008): Number of enrolled students from the local population and retention of graduates in the region, similarly JRC (2013) mention percentage of graduates employed in the region.

Edwards and Marinelli (2018): Number of start-ups/spin-offs

1. HE qualification of VET/UAS teachers;
2. Employability of graduates in the region (helping retain and attract talent).

EU (2018) focuses on:

1. The number of graduates in ICT and digital technologies;
2. The ratio of demand for ICT and digital technologies specialists and number of respective graduates (or vacancies for the ICT skilled employment);
3. The ratio of demand for smart specialisation specialists and the number of respective graduates.
4. Investments for the development of economic competencies.

Marhl and Pausits (2011) propose to track:

1. Number/cost of staff/student hours made available to deliver services and facilities to the community;
2. The number of community participants in educational outreach activity.

EU (2017) suggests tracking:

1. The number of supervisions of thesis with industry;
2. The number of learning days from the industry;
3. Percentage of PhD undertaken jointly with a non-academic partner;
4. Participation of non-academic agents in curriculum development.

OECD (2007) is focused on the number of work-based learning programmes and problem-based learning.

Probst et al (2019) propose to track: data on the male/female ratio in STEM/ STEAM programmes.

U-Multirank focuses on the share of regional students and graduates, and student internships in the region: Student internships in the region / out of the students who did an internship, the percentage for which the internship was with a company or organisation located in the region.

Qualitative indicators

Edwards and Marinell (2018) mention the existence of industrial PhDs.

Goddard and Puukka (2008) write about knowledge transfer via teaching (work-based learning), graduate recruitment, professional development/continuing education.

These indicators can be found in JRC publication (2013):

1. Fields where the HE institution sees itself as a recognised world-class place of competence in teaching;
2. Where are potential partners, where are the main competitors located?
3. Which emerging new scientific competencies?
4. Which research issues and future technologies do you conceive as most promising (not only technological/natural sciences but also social sciences, arts, or other than mentioned above, etc.)?
5. With which enterprises or research institutes in your region/country do you cooperate and in which field (both in terms of skills development /training and research-related activities)?
6. Do you get a part of your budget from private investors for learning? This could also signal public underfunding.

Šebková and Roskovec (2017) give these examples:

1. Internships for students of education disciplines provided through a network developed (by the faculty of education) with secondary schools;
2. Support/enabling of practical training of students and HEI and local staff members in lifelong learning by Science and technology park of HEI;
3. The relevance of education in terms of the dynamics and requirements of the local and national labour market;
4. Existence of business centre(s) founded and used by the university (it provides business education for students);
5. E-learning as part of a university strategy.

Probst et al. (2019) suggest tracking: Curricula development impact the employability of students.

HEInnovate focuses on these aspects:

Mentoring and other personal development relationships (such as coaching and tutoring) can help start-up entrepreneurs identify and overcome problems and develop their business networks. They provide valuable support in the form of knowledge, experience, social capital and encouragement on a long-term basis. Mentors and coaches tend to be experienced (academic) entrepreneurs, company managers and often alumni.

To receive high scores, an HEI should, for example:

- Offer mentor and other forms of personal development by experienced individuals from academia or industry;
- Organise visible, accessible and good-quality mentoring and personal development activities;
- Actively recruit mentors and provide them with training, resources, formal recognition and rewards;
- Facilitate the matchmaking of mentors and protégés;
- Provide feedback mechanisms on the contributions from entrepreneurs;
- Provide opportunities for peer-to-peer mentoring, such as entrepreneur clubs, where members help each other.

The HEI supports its students, graduates and staff to move from idea generation to business creation.

An HEI can support motivated students, graduates and staff in taking their first steps in preparing for a start-up. This includes developing an idea, finding a team, and exploring the technical and market feasibility of a project. As well as introducing staff to new networks, an HEI can offer regular activities to generate and evaluate business ideas emerging across the institution. To be scored highly, an HEI should, for example:

- Offer entrepreneurial team-building support and conflict management;
- Provide intellectual property assistance for potential start-ups;
- Create an expert advisory panel for early-stage concepts;
- Organise interdisciplinary idea generation activities (e.g. start-up weekends);
- Organise idea and start-up pitch prizes;
- Offer funds to support market feasibility studies.

The HEI co-designs and delivers the curriculum with external stakeholders.

External stakeholders are an important source of expertise that can be used in entrepreneurial teaching and learning. Regular engagement with external stakeholders encourages long-term collaborative relationships that can provide useful inputs to understanding future skills needs as well.

To score highly, an HEI could, for example:

- Regularly review and assess the involvement of external stakeholders in course design and delivery;
- Provide a mechanism for staff to work with external stakeholders to develop and deliver the high-quality course content;
- Integrate external stakeholders' experience and expertise into the development and delivery of extracurricular learning activities and support services;
- Support a diversity of collaborative partnerships with local communities and organisations, local and regional governments, chambers of commerce, industry and HEI alumni.

The HEI provides opportunities for staff and students to take part in innovative activities with business / the external environment.

An entrepreneurial HEI engages with the external environment through a variety of innovative activities:

- Provide open spaces and facilities for collaboration with external actors;
- Organise events that encourage engagement with external stakeholders, such as lectures, joint workshops, breakfast meetings and other networking events and opportunities;
- Encourage, support and recognise mobility of staff and students through internships, sabbaticals, dedicated study programmes (e.g. industrial doctorates, sandwich programmes).

Partial summary

Based on the literature review, the UAS should focus on the number/share of students enrolled from the region and the number/share of students who remain in the region after graduation. Graduate employment also can be tracked. It would be useful to know the share of the time dedicated to work-based learning and internships (out of the time for learning), and the share of learning courses that are provided in the online or hybrid form used by regional students. However, indicators which are based on the distance from UAS mention by Bonncorsi et al. (2019) are very difficult to monitor. The impact of the production of graduates in selected fields on employability and economic growth is questionable.

We do not regard it as useful to track data about overqualification, because the labour market is and will be dynamic. Education should not be focused only on the labour market, but HEIs bear social (Bennerworth & Jongbloed, 2010; Grau et al., 2017) and democratic values (Bergan 2005, 2016).¹³ The second argument is that the training of lower qualified workforce may have an impact on the development of the region (e.g. companies in the region want secondary educated workers, however with the fast development of the industry 4.0, the higher secondary education skills may not be sufficient for the future. Also, secondary educated workers have lower salaries)¹⁴.

The UAS should focus on self-reflection of active teaching and learning methods, interdisciplinarity and involvement of external actors and out-of-school experience to the learning process, and not forget the development of teaching skills and knowledge of teachers (their personal and professional development) in cooperation with external regional stakeholders.

¹³ For more see project DASCHE, www.dasche.eu

¹⁴ For more read Beseda and Šmídová (2016).

2.3 UAS capacity for the region

The UAS capacity for the region encompasses the UAS' service mission, whether through in-reach or outreach to the local business and communities. Different mechanisms can be used in this domain, for instance: enabling student volunteering or student service learning, making on-campus activities or services available to outsiders, providing informal knowledge exchange activities, contributing to the wider civic life of the region (community) through speaking to regional media, opening the use of university facilities and services to the public in sports and recreation, culture (theatres, museums etc.) and knowledge development (libraries, science parks). HEIs' research centres that advise regional stakeholders can also be included in this category. (Hart, Northmore & Gerhard, 2009; Bonaccorsi et al., 2019; Benneworth et al., 2018)

The UAS can also promote public formal and informal dialogue and facilitate communication among different (regional) actors. The public information websites can also address the regional needs (e.g. health, security etc.) (Bonaccorsi et al., 2019; Benneworth et al., 2018) and help build networks of actors (Šebková & Roskovec, 2017).

Several authors emphasize that HEIs should actively collaborate with regional actors. Increasing collaboration between different parts of the education system – schools, VET and UAS as well as research-intensive universities, enterprise and civil society through joint projects, sharing facilities etc. -are key to ensuring that the regional networks are strong; HEIs, such as UAS, can play a role as neutral regional brokers in strengthening these ties. (OECD, 2007; Goddard & Puukka, 2008; Puukka et al., 2013; Hazelkorn & Edwards, 2019).

The establishment of shared services and units by HEIs can lead to significant cost savings and more strategic collaboration. For instance, setting up a shared regional (virtual) office or joint industrial liaison office of all HEIs would help pool together the respective services of the HEIs in the region, make this offer more visible to regional and other actors, support the development of the institutional capacity of the participating HEIs, and generally help scale up individual good practice to a well-developed system. This development would be facilitated by the development of the association of HEIs in the region which could cooperate on developing regional higher education systems including the specialisation role of each HEI (OECD, 2007; Goddard & Puukka, 2008). UAS also play an important role in building the infrastructure for commercialisation (EU, 2017) and cooperating with regional organisations such as hospitals (Šebková & Roskovec, 2017). Šebková & Roskovec (2017) also stress the important role that UAS can play in the protection of the cultural heritage of the region and developing regional identity.

Good practice

We present one of the objectives (and related actions) of the Strategic Plan of the Polytechnic Institute of Bragança (IPB) 2018-2022, namely the objective "Promote the Open Campus" that is under development. Based on this objective, IPB promotes sport (holding events to promote sport and healthy lifestyles (hiking, cycling, others)), disseminates science through exhibitions, festivals and summer initiatives and also organizes cultural activities with the Theater of Bragança, Museums and Arts Schools. IPB promotes artistic activities, namely within the scope of Collaborative Laboratory Arts on the Mountain Graça Morais and the health and well-being of the IPB community (Develop the U-Bike project; support the "IPB gardens"; promote activities to encourage healthy living habits). (Pires, & Justino 2020).

Indicators for the UAS capacity for the region

Quantitative indicators

Benneworth et al. (2018) mention the following indicators from the E3M project¹⁵:

1. Number of events open to community/public;
2. Number of research initiatives with direct impact on the community;
3. Number of facilities available for people from the region;
4. Number/cost of staff/student hours made available to deliver services and facilities to the community;
5. Number of people attending/using facilities;
6. Estimation of the economic value for the community of using free or reduced-cost services and facilities by HEI.

U-Multirank has an indicator for community service-learning = the percentage of credits given in service-learning activities, in relation to the total number of credits. Service-learning involves students in community service activities and applies the experience to personal and academic development (not explicitly focused on the region but it could be seen as regional engagement).

Qualitative indicators

Goddard and Puukka (2008) stress the positive impact of

1. Programmes focused on collaborative working between HEIs and their regional partners;
2. Establishment of an association of all HEIs in the region; a joint industrial liaison office; or HEIs' regional office which can help scale up HEIs' capacity from individual good practice cases to a well-developed system;
3. Developing regional higher education systems with strong interdependence of the HEIs along with specialisations.

Bonaccorsi et al. (2019) suggest these 2 indicators:

1. Data on HEI participation in business and/or public consultations, projects, etc.;
2. Public opinion about the universities' contribution to the region's social and cultural life.

Šebková and Roskovec (2017) describe these examples:

1. The exploitation of cultural facilities (museum, cinema) for learning: International festival of popular science films supported with the network of research/development institutions, an interactive science museum, which aims to popularize science for the general public;
2. Compliance of graduates' knowledge with the requirements of employers;
3. Faculty cooperation with industrial enterprises in the region and with regional self-government;
4. Projects aimed at the protection of the cultural heritage of the region;
5. Organization (co-organization) of cultural events, cooperation with cultural and artistic organisations in the region;
6. Cooperation of faculty and hospitals in various cities of the region through the regional-wide practice-based health institution (health care area).

¹⁵ E3M project (n.d.). Conceptual Framework for Third Mission Indicator Definition, Retrieved from <http://e3mproject.eu/Concep-Framework-Third-Mission-Indicator.pdf>. The webpage does not work

EU (2017) proposes the Services provided within commercialisation infrastructure (Yes/No) as an indicator.

HEInnovate has this indicator:

The HEI is a driving force for entrepreneurship and innovation in regional, social and community development.

An HEI can play several roles in its community and the wider ecosystem. One of the key functions of an HEI is to support and drive regional, social and community development.

To score highly, an HEI could, for example:

- Be actively involved in the development and implementation of the local, regional and/or national innovation and entrepreneurship strategies;
- Provide general access to the facilities of the institution to others in the wider community;
- Support start-ups and/or established companies in the region to enhance innovation and growth;
- Have a strong presence in its communities, for example, by supporting local cultural and artistic activities.

Partial summary

We estimate that it would be useful for the UAS to use the quantitative indicators from the E3M project (Benneworth et al., 2018). The U-Multirank indicators could also be considered, given that many UAS are already using them. Furthermore, collecting qualitative information from regional actors on their views about the UAS activities could be useful, but it should be done structurally and based on evidence. The form of this indicator needs to be carefully considered.

2.4 Research, development and innovation and new business development for the region

The RDI and new business development category cover diverse measures and mechanisms such as (i) business access to research expertise, (ii) RDI for/with companies, (iii) access to UAS resources (staff, equipment); (iv) spin-offs, and (v) business incubators. HEIs can play a role in regional innovation through spin-offs, start-ups, incubators, licenses and patenting activity, science park, and contract research with third parties which may use the HEI equipment, premises, laboratories and also the human capital – researchers, teachers and students, which can work on research task or giving advice (Benneworth et al., 2018; RECAPHE, 2019; Foray et al., 2012; Šebková & Roskovec, 2017; EU 2017). The regional industry can also sponsor academic chairs (EU 2017).

Curtain (2004) notes that UAS “could have a more direct role in promoting and diffusing smaller-scale innovations focused on processes and development rather than the sector seeking to engage in pure research. This would enable this education sector to diffuse business innova-

tion and enhance its links with business, particularly with small and medium-sized enterprises in general and especially those in regional areas.” (italics added by authors)

Barriers include the weak capacity and capability of UAS for applied research, which is manifested in the lack of appropriate and corresponding support for teachers/academic staff (Hazelkorn and Edwards, 2019). UAS should also take into account the balance between “non-scientific” knowledge (such as design, marketing and tooling-up) and research/development (Goddard and Puukka, 2008).

While some authors recommend the UAS should ask themselves in which fields they have recognised world-class competence in research, in our view more relevant questions for the UAS are the following, defined by the JRC (2013):

- Where are the potential partners, and the main competitors located?
- Which research issues and future technologies are most promising for the UAS (not only technological/natural sciences but also social sciences, arts etc.)?
- With which enterprises or research institutes in your region/country do you cooperate and in which field (both in terms of skills development /training and research-related activities)?
- Do you get a part of your budget from private investors?
- What are important research infrastructure and creativity hotspots in the region and how are the infrastructure/hotspot accessible in other regions, countries?
- Is there mobility between the UAS staff and the private sector?
- Is there interdisciplinary cooperation?
- What are the working conditions of researchers in the region?
- Do you have international cooperation in your research area?
- Do you have international researchers and students in your HEI?

Probst et al. (2019) also underline the multi-disciplinary approach and digital transformation.

Good practice

In Germany, investment has led to over 150 highly successful spin-off companies and recognition of UAS in Germany’s innovation system, which is similar to the experience in Ireland with the institute of technology sector; the latter is currently undergoing a rigorous process of re-designation as technological universities. All of these examples of investments into applied research of UAS help to stimulate partnerships with regional SMEs and, therefore, to support regional development and innovation. (Kyvik and Lepori (2010) in Hazelkorn and Edwards 2019, p. 22)

Indicators for research and innovation

Quantitative indicators

Benneworth et al. (2018, p. 118) mention that the Australian Universities Community Engagement Alliance uses these indicators :

1. Numbers of publications or presentations where partners are co-authors, or acknowledged, as a percentage of all publications and presentations;
2. Numbers of externally funded collaborative grants as a proportion of all research grants;

3. Numbers of internally funded collaborative grants as a proportion of all internally funded grants;
4. Partners' perception of the value of research;
5. Publication of research outcomes on website, newsletters and media.

JRC (2013) proposes these indicators:

1. Percentage and figures quantifying the mobility of graduates/engineers/ professors moving between universities and firms and back;
2. Percentage and figures quantifying the scale of entrepreneurial education and training;
3. Salaries for the researchers in the region;
4. Percentage and figures quantifying the scale of international/ European cooperation and engagement in research programmes;
5. Numbers of permanent and temporary international research fellows, professors, and students in HE institution.

These indicators are suggested by Bonaccorsi et al. (2019):

1. The causal relation between research output (as measured by the volume of Scopus publications) and the rate of growth of real GDP per capita;
2. Investments in R&D and dynamics in local patent production from private and public funding;
3. Data on University research performance, territorial competitiveness, labour market efficiency, and innovation capability of the region;
4. Increase in regional patent activity and increase in citation per patent;
5. Data on University entrepreneurship results such as companies owned by academic staff, and/or student, and/or graduates, number of companies owned by academic staff/students, number of start-ups, turnover of the above companies and share of the turnover of the region;
6. The share of the above products and services in the region's economy;
7. Data on UAS capacity building and creative skills of graduates, and innovations;
8. Funds for research, salaries, and other expenditures (equipment, infrastructure, supplies);
9. Relationship between research and local industry.

Mahrl and Pausits (2011) recommend using the number of research initiatives with direct impact on the community as an indicator.

Šebková and Roskovec (2017) suggest a simple measure of the number of resources from the contracted researcher as an indicator.

EU (2017) mentions:

1. Research funded by industry and foundations (percentage of the total, total value, number of projects);
2. Income, total value, number of contracts/co-authorship, co-patenting/ participation in RD programmes, number of collaborative projects, income from associated projects;
3. Number of new/ granted patents software licences;
4. The number of start-ups, spinoffs, graduate start-ups, HEI owned start-ups, survival rates (3-5 years after start);
5. Percentage of spin-off located on the campus;
6. Total equity funding of spin-starts up;

7. The number of publication between research and industry;
8. Number of the sponsored academic chairs by industry;
9. Alternative capitalization of start-ups/spin-outs 3-5 years after the start;
10. Number of start-up employees 3-5 years after the establishment.

U-Multirank tracks: the percentage of the university's research publications that list at least one co-author with an affiliate address located in the same spatial region (within a distance of 50 km). The reason is that co-publications with authors located elsewhere in the institution's geographical region are a reflection of regional linkages between the university and regional partners.

Qualitative indicators

Goddard and Puukka (2008) suggest a balance between non-scientific knowledge (such as design, marketing and tooling-up) and research/development as the qualitative indicator.

Forray et al. (2012) suggest these areas:

1. Business incubators for spin-offs;
2. Expert advice and services to SME's. Healthcare, healthy and active ageing, e-accessibility, assisted living, e-government, access to public information, resource efficiency, smart grids, intelligent transport, safety, e-commerce, manufacturing, design, public services, e-education, e-inclusion, e-skills, entrepreneurship, digital literacy, e-content, creativity, culture, living labs, smart buildings and neighbourhoods, smart cities, trust, security, etc.;
3. Accelerators and mentoring facilities for start-ups; web entrepreneur camps, good practices exchange, peer review, studies, regular mapping of infrastructure, monitoring and benchmarking, development, expertise; innovative investment models; pre-commercial procurement and other related innovative procurement activities including reinforcing cross border and international collaboration in preparing the digital growth actions.

As qualitative indicators JRC (2013) recommends:

1. Potential partners and the main competitors as well as where are they located;
2. Emerging new scientific competencies (other than mentioned above);
3. Most promising research issues and future technologies;
4. Enterprises or research institutes in your region/country you cooperate and in which field;
5. Budget partly from private investors;
6. Description of the situation;
7. Professors who are invited to the business and vice-versa;
8. Information on the cooperation of the different faculties;
9. Other motivators for the researchers in the region.

Šebková and Roskovec (2017) mention: the existence of a network of research and development institutions including HEI faculties.

HEInnovate focuses on:

HEI offers or facilitates access to business incubation.

Business incubators commonly provide a range of services such as free or subsidised premises, access to laboratories and research facilities, prototyping support, IT and secretarial services and networking. They also offer a visible and accessible location for entrepreneurs to access an integrated package of coaching, mentoring, training, shared platforms and financing.

To score highly, an HEI could, for example:

- Host their incubators or facilitate easy access to external incubators;
- Ensure that their incubators offer a full range of soft support (networking, mentoring, etc.) as well as physical infrastructure;
- Promote the incubator widely across campus and host events that engage potential entrepreneurs;
- Embed the incubation facilities with the research and education infrastructure of the HEI to enhance synergies.

The HEI facilitates access to financing for its entrepreneurs.

External financing can be essential for the success of a new venture, e.g. providing investment for feasibility and market studies, product and prototype development such as proof of concept funding, for initial production or for offering the founders some living income before their first revenues are generated.

To be scored highly, an HEI could, for example:

- Facilitate access to financing for its entrepreneurs;
- Offer financial education to entrepreneurs and potential entrepreneurs to better understand financial concepts and how to apply them;
- Organise networking and financing events for aspiring entrepreneurs to pitch their ideas to investors and to get feedback;
- Offer microfinance instruments such as grants, prizes, loans and equity;
- Utilise its network of potential investors for crowd-funding;
- Closely link access to financing activities with training, mentoring and incubation.

The HEI has strong links with incubators, science parks and other external initiatives.

Knowledge-intensive structures surrounding an HEI provides opportunities to exchange knowledge and ideas. These include incubators, science parks and other initiatives. An innovative HEI should have systems in place that allow both inward and outward flows of knowledge and ideas.

To be scored highly, an HEI could, for example:

- Encourage the joint use of facilities;
- Have direct financial or management interest in science parks and incubators, ranging from participation to ownership;
- Ensure that the flow of people is incentivised in both directions;
- Monitor the added value generated through linkages and cross-fertilisation activities.

Partial summary

There are many possible quantitative indicators for regional research and innovation. The selection should be made carefully and based on the capabilities of the UAS and the opportunities and challenges emerging from the regions.

The U-Multirank tracking appears to pose some challenges to the UAS. For instance, the number of regional publications where the co-author is within a distance of 50 km of the UAS is seen as problematic (the question is how the 50 km are counted and whether 50 km is an insufficient distance in some regions).

The causal relation between research output (as measured by the volume of Scopus publications) and the rate of growth of real GDP per capita does not provide a useful metric for the UAS, especially as UAS tend to have a low number of publications (in Scopus).

As for qualitative indicators, we propose to describe the most important research innovations, research-based business activities, the existence of research and development networks and the biggest challenges in this area.

2.5 Social and cultural innovation

Social innovations refer to HEIs' activities that focus on society, NGOs, and local government; research embedded in the social fabric; expertise addressing social challenges in the region, and social incubators. Public (regional) policies have often prioritised the uptake and development of high technologies, while mechanisms to support social entrepreneurship and innovation for the wider needs of excluded groups in rural areas and inner cities have been limited. There has also been less emphasis on the field of Services, which account for 70% of the workforce in the OECD countries (OECD, 2007).

Benneworth et al. (2018) stress the importance of HEIs developing social networks in their regions. This can refer to measures such as guiding students by a mentor from a social facility/charitable organization; students' practical training provided by an NGO with the focus on social care; the existence of a centre for the development of practical knowledge and skills in the field of social work and social care. Cooperation of HEI with Labour and Social Welfare office, work on social projects, participation in the (international)¹⁶ social network (Šebková & Roskovec, 2017).

The EU (2017) covers under this category the creative industries and social engagement, and their presence in the HEIs policies. These include a dedicated budget for social engagement; HEI staff engaged in social engagement, events in social engagement research initiatives with direct impact on the community, and students resources (time and finances) dedicated to social engagement.

Good practice

Volunteering can be used as an example of good practice in this area. Staff and students from the Irish institutes of technology volunteer with a range of community organisations and initiatives. (Wiseman & O'Reilly, 2020).

¹⁶ Connection of local actors with international helps to exchange knowledge and develop the region

- Limerick IT and MTU Kerry Campus¹⁷ participate in the Campus Engage student volunteer portal
- The Waterford IT Access Volunteer Programme¹⁸ works with the wider local community to promote access to Further and Higher Education. This is achieved by developing links with local schools and community groups and by equipping volunteers with appropriate experience and transferable skills such as communication, teamwork, and project (see footnote 17).

Indicators for social and cultural innovation

Quantitative indicators

Marhl and Pausists (2011) recommend tracking the percentage of academics involved in volunteering and advisory activities.

The EU (2017) proposes the following metrics: usage (view, downloads), captures /bookmarks, shares/ mentions in blog, wiki etc; Social Media (FB likes, followers, Tweets), Citations (WoS, Scopus). This should not necessarily indicate social engagement. However, the data can show how stakeholders are interested in the activities of UAS. Other metrics include: (i) the number of academics engaged in social engagement, (ii) number of social engagement events, (iii) number of initiatives, (iv) amount of time and costs dedicated to social engagement, (v) attendance at social engagement events, and (vi) number of facilities dedicated to social engagement.

Qualitative indicators

Edwards and Marinelli (2018) propose to track: (i) consultancy activity with public administrations and non-profits, (ii) pertinent prizes and labels, (iii) support for social sciences and humanities (to provide social analyses to understand socio-economic needs, (iv) cultural industries and industries such as media, tourism etc., (v) exploitation of new tools and methods of engagement with public and private ecosystem...), (vi) the influence of HEIs in cities' social and cultural life. They underline the necessity of the existence of monitoring systems supported by HEIs (design, data collection, analysis, training for monitoring) and focus on researchers' social responsibility to the place where they live and work and their behaviour as active citizens.

Šebková and Roskovec (2017) propose that UAS should ask about:

1. Existence of the centre for the development of practical knowledge and skills in the field of social work and social care;
2. Cooperation of HEI with Labour and Social Welfare office;
3. Work on social projects financed from external sources;
4. HEI participation in the (international) social network.

EU (2017) suggests that the HEIs should ask themselves if: (i) the 3rd role is included in the HEI institutional policies, and (ii) if there is a dedicated budget for social engagement. In the absence of indicators, there should be a description of examples of social engagement and an anecdotal approach could be used. (EU, 2017)

¹⁷ <https://www.studentvolunteer.ie/>

¹⁸ https://www.wit.ie/current_students/student_life_and_learning/wit_access_volunteer_training_programmes1

Partial summary

For the category Social and cultural innovation, quantitative indicators could include the percentage of academics involved in volunteering and advisory activities (Marhl & Pausists, 2011), maybe it could be supplied with the number of contracts with social and cultural institutions. We can see also as a good indication that the HEIs should ask themselves if: (i) the 3rd role is included in the HEI institutional policies; and (ii) if there is a dedicated budget for social engagement (EU 2017), which could supply individual UAS with specific targets in the area of social and cultural innovation.

2.6 Lifelong learning

Regionally relevant lifelong learning activities include public lectures, professional education and adult learning provision, capacity building, continuing education programmes, clinical programmes, practical education for citizenship, outreach programmes developed for the community, such as non-credit courses, tutoring, training programmes, learning centres, professional development centres, evaluation support (Benneworth et al., 2018, Goddard & Puukka, 2008) and universities/academies of the Third Age (Šebková & Roskovec, 2017).

Universities can also participate in schemes promoting the training and placement of high-level graduates in innovative businesses (Foray et al., 2012).

Competency-based education seeks to offer a much more flexible approach that will support adult, part-time and mobile learners (Weise, 2014). Similarly, recognition of prior learning involves novel ways to assess what a person has already learned through other modes of learning and life experience (Hazelkorn & Edwards, 2019), this approach can help with reskilling and upskilling of the regional population.

Good practice

The School of Lifelong Learning and Education in Waterford IT¹⁹ was established in 2004. The School is home to two academic departments (Education and Lifelong Learning) and two centres; the Centre for Technology Enhanced Learning and the Literacy Development Centre (the national centre for professional development for practitioners working in adult literacy). The School is responsible for leading the development of flexible, part-time and technology-enhanced programmes across the Institute specifically targeted at adult learners. The Education faculty in the School is responsible for the design and development of programmes for educators, research into the field of education and engagement with education partners at a regional, national and international level. (Wiseman & O'Reilly, 2020).

Indicators for lifelong learning

Quantitative indicators

Šebková and Roskovec (2017) suggest numbers of 3rd age university students as a quantitative indicator.

¹⁹ <https://www.wit.ie/schools/education/welcome>

EU (2017) proposes to track the percentage of non-academics teaching in courses (NGO, companies, public sector).

We can also track the number of provided lifelong learning courses (of different length: up to 16 hours, 16 to 100 hours and more than 100 hours) and the number of students who participated (Czech practice which is required as indicators by the Ministry of Education, Youth and Sports).

Qualitative indicators

Edwards and Marinelli (2018) suggest checking the role of HEI in the integration of entrepreneurs into a continuous learning process. Goddard and Puukka (2008) propose to look at the existence of adult learning opportunities with functioning pathways and cooperation. Foray et al. (2012) add training opportunities for graduates/placement opportunities for students. Šebková and Roskovec (2017) mention the cooperation of the University of the 3rd age with the regional authority (social department).

Partial summary

In the category of lifelong learning, UAS can track the number of lifelong learning students from the region.

2.7 Other

In this category, we have collected cases that are difficult to classify in the previous categories. This applies to the “income from services provided to local businesses through consultancy and professional training”. Some examples could fit partly to previous categories or some of them relate to more categories.

Foray et al. (2012) add that universities can provide valuable input to innovative clusters and networks.

Moodie (2006, p. 134) points out that: UAS “can have a key position with respect to encouraging and facilitating the diffusion of knowledge to help what is called the “transformation of practice” to generate economic development.” UAS can develop the knowledge base of practice in different vocational fields, from business administration to child education, construction to design, and tourism to IT services. UAS institutions can help to develop, codify and institutionalize the knowledge base of practice; this should be explicit and built into their role (Hazelkorn and Edwards, 2019).

As Bonaccorsi et al. (2019) also state, universities bring to the regional economy not only the advantages that come from the spatial proximity, in terms of student education and research but also the access to **international networks of knowledge**. Regions with active universities are more internationalized and enjoy greater access to international networks. Graduate mobility weakens the link between the local presence of universities and the local economy. The effect of student and graduate mobility must be taken into account.

UAS can have also special boards, which appropriately support regional engagement/cooperation, as e.g. an industrial council as part of the faculty management (Šebková and Roskovec, 2017) or community members in HEI boards (EU, 2017).

EU (2017) mentions the importance of infrastructure for commercialisation, intellectual property as trademarks and design and also open-source property, community partnerships and graduates who stay to work in the region.

Good practice

The UAS in Flanders is actively involved in the STEM Academy Network²⁰, which promotes participation in STEM-related activities outside of the school walls. The teacher training programmes, as well as the STEM programmes within the UAS, are often involved in organising these activities. The UAS also report yearly to VLAIO, the Flemish Agency for Innovation and Entrepreneurship. (VLHORA, 2020).

Indicators

Quantitative indicators

Bonaccorsi et al. (2019) propose to use these indicators:

1. Indicators presenting the level of internationalisation (studies and research) of regional universities;
2. The short term direct positive impact of universities comes from:
 - a. direct expenditures of students and faculty;
 - b. expenditure of students and faculty who move into the area from other regions;
 - c. expenditures by the institution;
3. Enhancement of workers' skills:
 - a. relationship between research and local industry;
 - b. positive effects on business location (attraction of foreign investment).
4. Graduate mobility data (in and out).

EU (2017) proposes to track: intellectual property revenue and total costs, number of design and trademarks, number of the open-source property²¹ (SW, blogs), number of community members in HEI boards and value of community partnerships.

U-Multirank and Probst et al. (2019) focus on the proportion of external research revenues - apart from government or local authority core/ recurrent grants – that comes from regional sources (i.e. industry, private organisations, charities). The reason is that A high proportion of income from regional/ local sources indicates a more intense relationship between the university and the region.

Qualitative indicators

The EU (2017) proposes to ask if the UAS has received seed investment, has (non)-financial incentives for staff if they generate intellectual property.

²⁰ <https://www.technopolis.be/nl/stem-academie/>

²¹ Open source propererty are artefact which are created under open source licenses.They allow software to be freely used, modified, and shared

Benneworth et al. (2018) suggest asking the following questions:

- What relevant objectives are set for the institution in its founding document (charter or equivalent)?
- What relevant expectations are held by those who fund your work and support it (including politically)?
- Which external groups are represented ex officio and de facto on the institution's governance or senior management bodies? How are the relevant individuals chosen and how do they see their roles?

Foray et al. (2012) recommend focusing on innovative clusters/cooperation network.

Partial summary

From the category Others, we should consider the involvement of UAS in regional networks and how UAS connect regional and international actors. These issues could be addressed as horizontal/cross-cutting categories.

3. Summary

Based on the literature review, we can see there are a lot of (potential) indicators for tracking the different activities of UAS. We find the largest number of indicators in the categories Regional aspects of teaching and learning and Regional research and innovation, which can represent the first and the second role of UAS. However, the other categories which could be covered as the third role of UAS are not less important and we found there a lot of interesting indicators.

We can highlight for now the importance of developing a tool that can reflect the regional engagement of UAS. This means not only the economic or technical factors but also a reflection on the social, environmental and cultural aspects, measured by combining quantitative and qualitative indicators. To specify, we will probably use scales, where each category should be clearly defined. We will have to balance the complexity of the tools and any difficulties with the collection of data, which should not be too time-consuming while also being robust enough to allow some comparisons to inform HEI planning for improvement and development. We will also consider how we would use/build our work upon a tool like HEInnovate. We guess that using a similar scale as have **Common European Framework of Reference for Languages: Learning, Teaching, Assessment** would be useful.

Conclusions drawn from the existing models

Based on the review of the literature and of national reports, we propose rethinking our first model (see Table 1). The different categories represent different amount of activities, indicators and associated evidence basis for them. We see that there is overlap for some activities in categories 3. UAS capacity for region and 5. Social and cultural innovation and that the distinction between them is not very clear. We also think that would be useful to merge category 2 Regional aspects of teaching and learning and 6 Lifelong learning. We will add to the new model cross-cutting category Networking-internalisation.

Based on the perspective of the quadruple helix (JRC, 2013), we should have 4 categories: Providing Capacity for Regional Strategies Development; Developing Talents, Skills and Competencies Reflecting Regional Needs; Promoting Regions' Development through User-inspired Research and Innovation; Enhancing Social, Civic and Cultural Activities of the Regions' Community and cross-cutting Internalisation/Networking Local-Regional-International actors. This cross-cutting category underlines the role of UAS as catalysts for networking different actors and the interconnector of regional and international actors. The first draft of this model is presented in Table 2. The model will be refined further and used for the development of the UASiMAP self-reflection tool.

Table 2 OVERVIEW OF DIMENSIONS AND ACTIVITIES OF PHE INSTITUTIONS (UAS) WITHIN THEIR REGIONAL ENGAGEMENT

PROVIDING CAPACITY FOR REGIONAL STRATEGIES DEVELOPMENT	DEVELOPING TALENTS, SKILLS AND COMPETENCIES REFLECTING REGIONAL NEEDS	PROMOTING REGIONS' DEVELOPMENT THROUGH USER-INSPIRED RESEARCH AND INNOVATION	ENHANCING SOCIAL, CIVIC AND CULTURAL ACTIVITIES OF THE REGION'S COMMUNIT	
Embedding the regional role and dimension in the UAS mission, strategies and leadership	Offering programmes in accordance with regional interests and opportunities	Reflecting the regional context and aspects in the UAS RDI strategies & policies – profile, capacity, partnerships	Community-engaged teaching and learning including credit-bearing curricular activities and support for student volunteering	INTERNALISATION/NETWORKING LOCAL-REGIONAL-INTERNATIONAL
Integrating the regional role and dimension in the UAS governance and organisation	Encouraging participation from regional actors in program design	Providing expert capacity for regional actors' development	Research, development and innovation to investigate and provide solutions to issues of public interest or concern	
Valuing the regional role and engagement in the UAS staff policies	Delivering programs in partnership with regional actors	Providing the regional actors with access to the UAS RDI / facilities and equipment	Leveraging institutional knowledge and resources for social good	
Engaging in regional strategies, networks, partnerships, structures and bodies	Supporting Lifelong Learning on the regional level	Outputs of regional RDI cooperation	Building win-win systematic approaches to social, civic and community engagement	
		Promoting transfer of international knowledge to the region		
		Supporting region-focused research publications and their popularization		

4. Literature

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